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UNITED STATES DEPARTMENT OF AGRICULTURE



DEPARTMENT BULLETIN No. 1457



Washington, D. C.



May, 1927

DATE CULTURE IN EGYPT AND THE SUDAN

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By

SILAS C. MASON, Horticulturist

Office of Crop Physiology and Breeding, Bureau of Plant Industry, U. S. Department of Agriculture

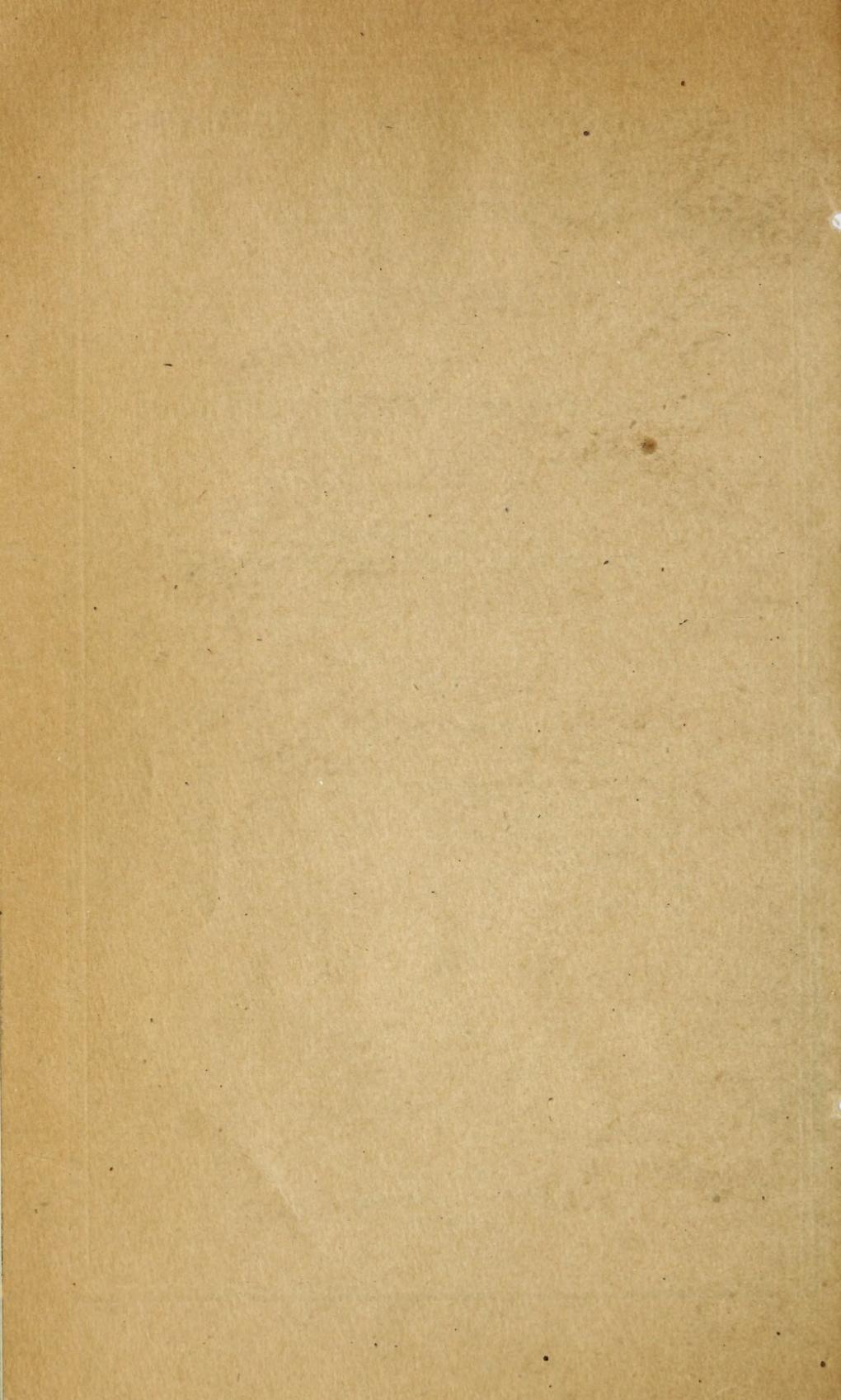
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By SILAS C. MASON, *Horticulturist, Office of Crop Physiology and Breeding,
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REGIONS AND CONDITIONS OF DATE CULTURE

The date industry in Egypt differs from that of most date-growing regions in comprising two large, well-defined districts where seedling date palms are almost exclusively grown, as well as three other districts widely separated where the culture of commercial varieties from offshoots prevails. In Algeria, Tunis, Mesopotamia, and other regions with long-established export trade in dates the commercial varieties propagated by offshoots almost wholly occupy the land planted to dates.

It requires a rather careful study of the economic agricultural conditions of Egypt to discover the causes which lead to the rather curious localizing of seedling or balady culture of dates in distinction from varietal cultures. (Pl. 1.)

Lower Egypt, including Giza Province, which extends about 15 miles above Cairo, constitutes the most important and extensive

region of varietal culture in Egypt, with approximately 2,200,000 trees.

The five scattered oases of the Libyan Desert, including from north to south Siwa, Baharia, Farafra, Dakhla, and Kharga, make up the second region of varietal culture,¹ roughly estimated to contain 500,000 palms.

Four rather disjointed portions of the Nile Valley above the storage basin of the Aswan Dam, from Korosko and Ibrim, through the Sukkot district past the Third Cataract and around the great Dongola bend and past the Fourth Cataract to Berber and Atbara, practically the southern limit of Nile Valley date culture, are comprised in the third region of varietal date culture.

The main Nile Valley from the upper limits of Giza Province on past Assiut, Luxor, and Esneh to the First Cataract at Aswan, comprises the first great seedling-date district, with about 3,500,000 trees; and the detached Oasis of Fayum constitutes the second, with 500,000 trees.

In both of the seedling regions a few trees of choice named varieties of reputation in other Provinces may be found in the gardens of the more wealthy and intelligent people, and throughout the Nile Valley an occasional superior seedling may be cherished by the same class of people.

VARIETAL CULTURE IN LOWER EGYPT

Considering the conditions in Lower Egypt which lead to varietal cultivation of dates, it is the most important region of diverse agriculture in the entire valley, and date culture forms but a small part of the entire agricultural industry. As a rule the richer and more valuable lands are devoted to the staple crops—cotton, maize, and wheat. Citrus and deciduous fruits are grown in small areas, considerable areas are in onions and other vegetables, and berseem, the chief forage of hundreds of dairy cows, is grown as a winter crop.

The more sandy or salty and less highly remunerative lands are left to date culture—usually lands bordering the richer Delta area, the dune lands fronting the Mediterranean, and the more sandy lands bordering the desert on the east and west.

Besides its teeming population of village dwellers, Lower Egypt has more than 1,500,000 people in 13 cities of from 25,000 to 800,000 population, all lovers of fresh dates from childhood.

It is easily seen how an extensive commerce in the crisp, juicy Hayany, and other varieties in the rutab (fresh) stage has developed. Dates in this hard-ripe condition need to be shipped but short distances to reach the consumer. No time need be lost in curing them in drying yards, no labor involved in turning, piling, or sorting, and no tedious skill in packing in layers, as for long-distance shipments. The most inexpensive crates and braided baskets serve as containers. The product is quickly marketed and quickly consumed, the price thus reaching the purse of the grower, leaving the customer eager for another shipment.

The Hayany is par excellence the variety that meets these conditions.

¹ The spelling of oasis names, except where quoted, follows that used by the surveys department of the Public Works Ministry of Egypt.

THE LOCALIZING OF EGYPTIAN VARIETIES

Date growing in Egypt, like many other agricultural industries, is subject to curious localizations, seemingly in no way related to soil or climatic fitness. A small district has almost a monopoly of flax growing, another of mishmish, or apricots; still another, in Fayum, is devoted to olives.

The date varieties are similarly localized, the Samany and Zagloul being largely centered around Edku and Rasheid, the Amri along the eastern Delta border, the Amhat and Saidy (Sewi) in upper Giza Province, the Hayany alone of the commercial varieties enjoying a rather wide range—from the Mediterranean shore to Birket el Haggi and upper Giza, and on both sides of the valley, from Facous and El Qurein on the east to Kerdasch on the west. Possibly this may argue a greater age as well as a more universal demand for the Hayany.

EGYPT'S SMALL EXPORT-DATE INDUSTRY

The sandy border of the Delta toward the eastern desert has developed the only export-date culture in Egypt in the growing of the Amri variety, known for a century and fully described under "Leading commercial varieties."

Here is an export industry, largely due to the enterprise of Greek and Italian traders, where, in contrast with the curing and packing methods in vogue in other districts, considerable care and skill have been developed in producing a product which can compete with Basra and Tafilet dates in the English markets. Layer packing in neat pine boxes, with some attention to cleanliness and sanitation, has replaced the dusty drying yards and the tramping of masses of dates into braided baskets, which seem to satisfy the most exacting demands of the Cairo bazaars.

The Saidy date of the Libian oases—called "Sewi" in the upper Giza country (pl. 2)—is a date splendidly adapted to exportation, of much higher quality than the Amri, and when properly packed is capable of taking a place in the fancy-fruit markets of the world; yet with the demand made by the dense city population of Lower Egypt it is all consumed at home, and apparently there has not been sufficient inducement to prepare it in a condition that would enable it to find its place in the world markets.

VARIETAL DATE CULTURE IN THE LIBIAN OASES

The five oases of the Libian Desert (pl. 1), a journey of 4 to 10 days westward from the Nile but interconnected by very ancient routes of travel, have been from very remote times unwilling dependencies of Egypt. Records as far back as 1447 B. C. show that even then Siwa was famous for its dates and Kharga for its wines, both commodities being brought over to the valley in considerable quantities.

With scant manufacturing facilities, the problem, after finding bread for the people, was to produce some commodity readily transported and readily sold, which they could offer in exchange for the necessities and luxuries of the outside world.

Siwa Oasis, known to the ancient Egyptians by the name of "Sokhit Ami," or the "Orchard of Palms" (7),² must have satisfied its oasis neighbors of the greater stability of the date industry, for the wine trade of the more southern oases has long been superseded by that in dates. Doubtless thousands of seedlings had been weeded out as unprofitable before Cailliaud (4) compiled the first recorded list of five varieties at Siwa in 1819—"Gazaly (or Soultany), Freyeh, Saŷd, El Ka'yby, and Ouaedy."

Although the Ghazali (Sultani) date is still regarded as superior in quality to the Saidy, as it was in Cailliaud's time, when tested by vigor, yield, packing and transporting quality, and salability, the Saidy has been for more than 200 years the one great export date of the five Libyan Oases.

Edmonstone (8), writing in 1822, quotes Vansleb, a Dominican friar who traveled in Egypt and Nubia in 1672-1673, as stating:

The best dried dates come from Elwa [El Wah, a general term for the Libyan Oasis region], which region lies three days' journey inland from Siout. These are so fleshy and sweet that others would be considered sour and bitter after them.

That region of El Wah, "three days' journey inland from Siout" (Assiut), could have referred either to Kharga Oasis or to Baharia, but in either case with a considerable error in distance, as Poncet (15), in 1698, left "Siout" October 2 and reached "Helaone" (Kharga) October 6. Baharia is slightly farther from Assiut, but neither journey could be made in less than five or six days with loaded camels. Both oases have been heavy exporters of the Saidy date from our earliest accounts of them.

UPPER NILE VARIETAL DATE REGION

Varietal date culture beyond the First Cataract has been much curtailed in the Nubian region by the flooding of the narrow Nile bottoms by the waters impounded by the great barrage.

There yet remains a considerable area of culture in the district of Korosko and Kasr Ibrim, above which only scattering groves are recorded until the Sukkot country is reached. This country comprises a district below the Third Cataract and appears to have been the nucleus of date culture in the Sudan and Nubia.

Burckhardt (2), in reporting his journey up the Nile in 1813, wrote of very good dates at Korosko, but spoke more highly of the dates of Sukkot, which country he reached a little later. Still later he tells us that Merowe in the Dongola country had no good dates, but traded for the excellent dates of Sukkot. This was confirmed by the chief men of Merowe during the writer's visit in 1913. They said that 100 years ago they had no good dates, but that their four leading varieties, the Barakawi, Bentamoda, Gondeila, and Kulma, had been brought from Sukkot. As the distance across the Nile bend by caravan trail is only about 150 miles, this assertion seems very reasonable.

Traffic between this portion of the Nile Valley and Arabia across the Red Sea is very ancient; but, since the distance from the nearest

² Serial numbers in italic in parentheses refer to "Literature cited" at the end of this bulletin.

Red Sea port is about 450 miles, it is believed that seedlings rather than offshoots constituted the foundation of Sukkot date culture and that careful selection of seedlings built up the quality which has given the region its reputation.

In a recent visit to the date-growing Provinces of the Sudan, Berber, Dongola, and Halfa, considerable additional information was obtained pointing to the origin of the date varieties of the Sudan. In the district below the Fourth Cataract of the Nile, of which Nouri is the chief village, there are a few trees of an excellent soft or packing variety called Medina, which, it is said, originated many years ago from seed of packed dates brought from Medina by returning pilgrims. A small, soft variety called the Mishrigi is considerably planted in the Abu Hamed district, of the origin of which a similar account is given. On the other hand, there is a popular tradition in the lower Dongola and Halfa Provinces that the dates of Mahas and Sukkot, which formed the nucleus of Halfa date culture, sprang from seed brought by caravan across the Sahara Desert from Biskra.

Here comes in a most instructive case of the survival and spread of the date variety best fitted to the conditions of the country. In a little more than a century since Burckhardt's journey the Barakawi³ has become the chief commercial date of Nubia and the Sudan, with a culture running into thousands of feddans. Physiologically fitted to conditions of intense heat, with the driest air known of any date-producing region, this tree is vigorous in growth and propagation. It produces abundantly dates that in that atmosphere are so bone dry and hard that the natives say the weevils can not work on them.

Packing and shipping are reduced to the simplest terms. For the Kordofan trade two goat's hair sacks holding 160 pounds each are balanced over the crude saddle across the camel's back, and the caravan is ready for the desert. A few pounds of these dates soaked in a jar of water, as the journey continues, provide a refreshing drink and a nourishing meal, with no need for fire or baking powder. A caravan of 300 camels carrying these dates packed in brown goat's hair bags to the back country of Kordofan was formerly no unusual sight.

The Barakawi ("the blessing"), vigorous in growth and propagation, an abundant producer of large bone-dry dates of excellent food value, is to-day planted on every available acre of the narrow Nile bottoms of Dongola Province, and the offshoots are in such demand that no export orders will be considered.

From Sukkot at a very early day offshoots of Barakawi must have been brought down the river to Wadi Ibrim, Derr, and Korosko, the most southerly culture in Egypt proper, where they took the name of Sukkoti. As the surplus of these dates was sent down the river in the slow, heavy native trading boats they took also the name of Ibrimi (or Ibremee) from the region, all of which—the modern shabby village Ibrim and the tillable stretch of Nile bottom called Wadi Ibrim—derive their names from the old stronghold on the hillside, Kasr Ibrim. In Cairo both names may be heard in the native bazaars.

³ See varietal description, page 13.

In a carefully prepared account of the resources of the country about Aswan by Sir Gardner Wilkinson (22, vol. 2, p. 290) occurs this statement:

But the dates still retain the reputation they enjoyed in the days of Strabo, and the palm of Ibrem is cultivated and thrives in the climate of the First Cataract. * * * The best dates are the Ibremee. All cultivated palms are reared from shoots; those produced from the stone, in spite of cultivation bearing bad and wild fruit.

Later, after describing the sterile character of the Nubian sand-stone country and the precarious living which the people derive from the narrow and interrupted bits of Nile bottom land, the same author (22, vol. 2, p. 304) proceeds:

The palm tree, which there produces dates of very superior quality, is to them a great resource, both in the plentiful supply it affords for their own use and in the profitable exportation of its fruit to Egypt, where it is highly prized, especially that of the Ibremee kind. The fruit of this is much larger and of better flavor than of other palms, and the tree differs in the appearance of its leaves, which are of a finer and softer texture.

Still later he states (p. 322):

The district about Derr, on the east bank, abounds in date trees; and between that town and Korosko they reckon 20,000 that are taxed.

In her delightful account of a journey by "dahabeeyah" in 1873-1874, Amelia B. Edwards (9, p. 356) makes the following statement:

The palms of Derr and of the rich district beyond were the finest we saw throughout the journey. Straight and strong and magnificently plumed, they rose to an average height of 70 or 80 feet. * * * These superb plantations supply all Egypt with saplings and contribute a heavy tax to the revenue. * * * The fruit, sun dried and shriveled, is also sent northward in large quantities. * * * The trees are cultivated with strenuous industry by the natives, and owe as much of their perfection to laborious irrigation as to climate. The foot of each separate palm is surrounded by a circular trench into which the water is conducted by a small channel about 14 inches in width. Every palm grove stands in a network of these artificial runlets. * * * The reservoir from which they are supplied is filled by means of a sakkieh, or water wheel. * * * These sakkiehs are kept perpetually going, and are set so close just above Derr that the writer counted a line of 15 within the space of a single mile. There were probably quite as many on the opposite bank.

Whether or not "saplings" in the above account refers to offshoots, or "shettla," it is a fact that to this day small lots of offshoots of the Sukkot varieties find their way down the river to gardens about Aswan and even as far as Luxor.

Martius (10) makes a citation from Raffeneau-Delile (17), who refers to the "Ibrimy" taking its name from "urbe Ibrim" as the date most highly praised from Aswan. His description of the soft and flexible character of the leaves of this variety, as compared to the Egyptian date palms, coincides perfectly with the present writer's description of the leaves of the Barakawi, published in Department Bulletin No. 271 (12) from notes made at Merowe in Dongola Province in September, 1913.

The character of the fruit brought down the river to Cairo from various points in Upper Egypt under the name "Ibrimi" shows a good deal of variation from the true Barakawi, or Sukkoti, type. This suggests that a condition exists similar to that among the Hay-

⁴ The beauty of the palms at Derr in the early morning light was one of the most striking features of the writer's steamer journey from Halfa to Shellal, in April, 1925.

any trees of the Delta—the presence of numerous satellite seedlings, near enough to the parent type to be classed and sold with it commercially, yet showing distinct characters under close analysis.

Another of the Sukkot seedlings introduced into Dongola Province a century ago was the Bartamoda, or "Bentamoda,"⁵ in the vernacular of the region, the "new date"⁶—producing a semidry, rich, luscious fruit, but with a rather delicate habit of tree growth and propagation.

After more than a century it is still the "new date," of which a wealthy man may have perhaps two or three trees in his private garden from which to send presents of fruit to his most esteemed friends. The gift of an offshoot from it is worthy the gracious acceptance of one of the chief men of the Sudan. Found occasionally in gardens of the wealthy in the neighborhood of Aswan or Luxor, it is one of the choicest dates of Egypt, but commercially it has attained little importance.

In the foregoing examples it is seen how the selected and proved seedling dates of one generation become the commercial foundation of the next. The iron rule of commercial profitableness is sure to work out in the end. A variety which yields abundantly what people want, with long-keeping and good transportation qualities, if it propagates freely and is sturdy and vigorous under cultivation, eventually wins. These are apparently simple requirements, yet the small total number of high-class commercial dates known to-day testifies to how rarely such a combination is found.

SEEDLING DATES IN THE NILE VALLEY FROM GIZA TO THE FIRST CATARACT

In the great region of seedling-date supremacy lying between Giza on the north and the First Cataract of the Nile economic conditions differ in an important way from those of the Delta. Although densely populated, it yet lacks the large cities which afford the stable date markets of the Delta.

The 3,500,000 date trees are relatively but a fringe to the vast acreage of rich bottom lands devoted to sugar cane and cereals. The dense rural population furnishes a quick local market for all the dates produced, and with the insignificant exportation there has been little opportunity for a variety with commercial possibilities to gain prominence, except in a limited way about Aswan. Quantity rather than quality is demanded, and nothing goes to waste. There is rather a prevalence of the dry or bread-date type, with a resemblance to the "Ibrimi" from up the river.

In the gardens of the wealthy there are frequently found a few trees of the choice varieties from other sections, especially the Bartamoda⁷ from the Sukkot country, the date of luxury of all the upper Nile region. There are also a good many fine seedlings, the trees having often passed the offshoot-producing stage without being propagated. In some cases this may have been due to lack of offshoot production, but there are definite cases where seedling

⁵ See varietal description, page 15.

⁶ For this translation the writer is indebted to G. W. Murray, of London, who has spent much time in the region in geological work and has in preparation a vocabulary of Nubian and Sudanese words.

⁷ According to Murray, this is the form which the name Bentamoda takes in Upper Egypt.

varieties that would rank in quality of the fruit among the world's 10 best dates have simply been allowed to produce their 100 or 200 pounds of fruit a year for the owner without a single offshoot from them ever having been planted. The pride in a new variety, manifested by Americans in a desire to disseminate it far and wide, seems to be limited among these people to pride of personal possession.

There is probably no richer hunting ground for fine new dates to-day than the Nile Valley, if a method could be devised for starting offshoots on middle-aged or old trees. In this great region the utilization of the by-products of their date palms appears to have made little development beyond supplying local needs. Like any primitive people in a date-palm country, they look to the palm trees to supply a hundred domestic needs; but, beyond some very beautiful baskets manufactured about Aswan to be seen in Cairo bazaars, no export industry has stimulated the making of crates and cordage or baskets for hard service, such as are produced in great quantities in Lower Egypt and Fayum.

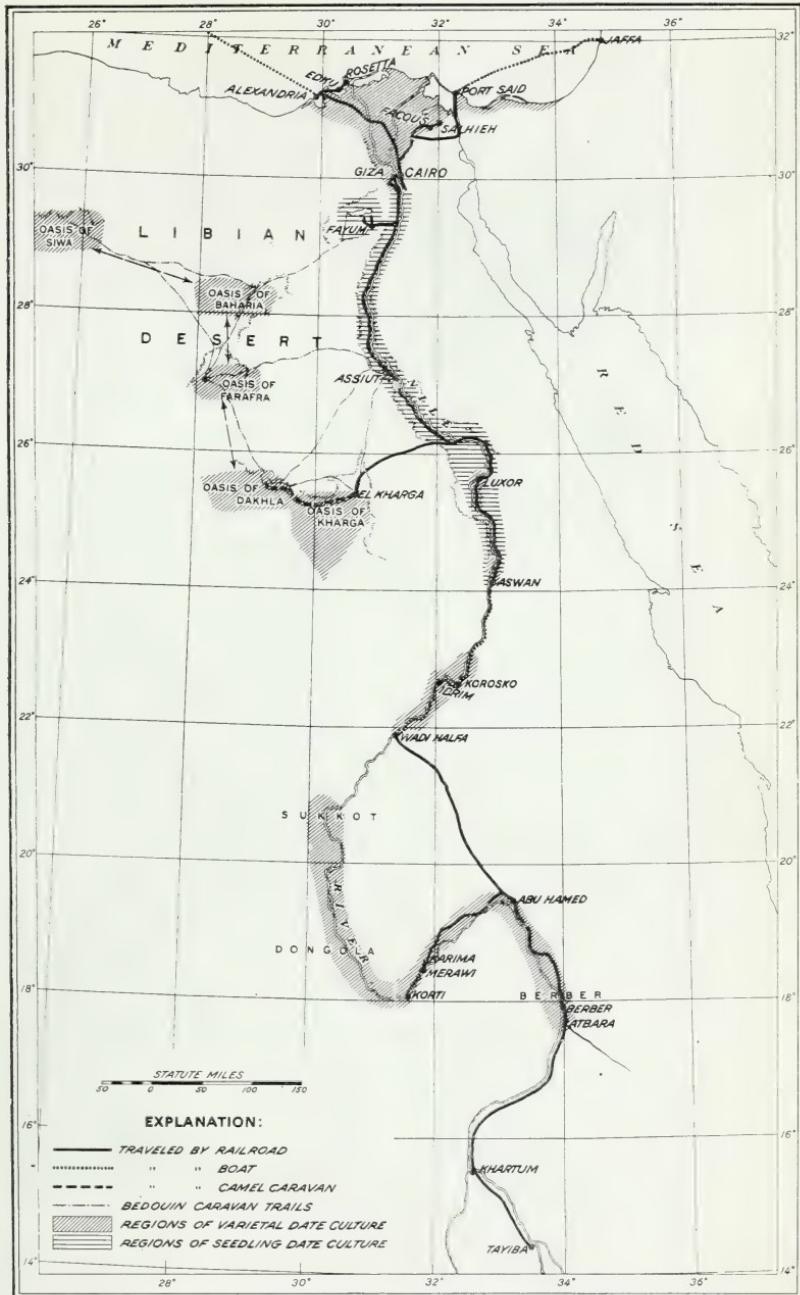
SEEDLING DATES IN THE FAYUM OASIS

Fayum is an oasis in a depression below the Nile about 75 miles southwest of Cairo. It is watered from the Bahr Yousef, a side channel, perhaps an ancient canal, diverging from the Nile far up the valley. It is connected with Cairo by a narrow-gauge railroad intersecting the main line at Wasta. The economic conditions in Fayum are peculiar, and the varietal culture of dates has found little encouragement. Light railways afford quick connections with the Nile Valley, and a variety of produce finds a ready market in Cairo and other Delta towns.

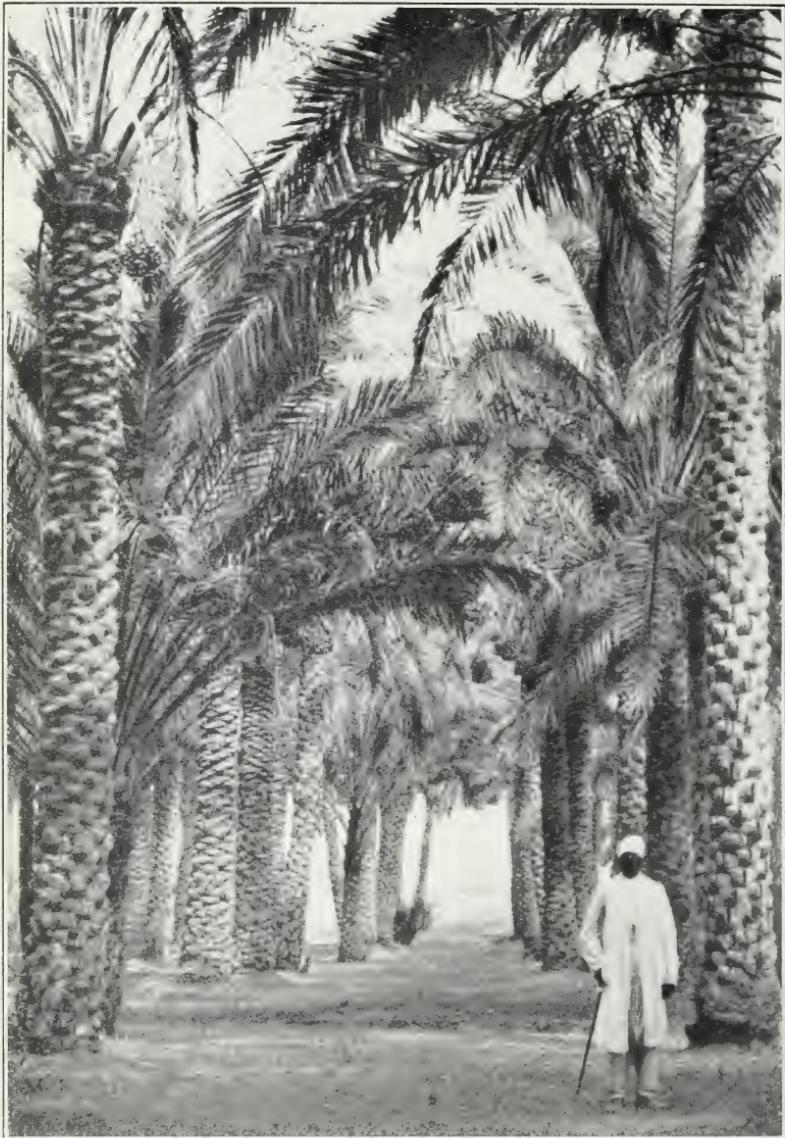
In Fayum there is a remarkable local specialization in agricultural products which has a very direct influence in maintaining seedling-date culture. One district is celebrated for its chickens, hatched in great numbers in a native type of incubator. In another figs are produced in large quantities under a special close-planting system developed in this district. Olives of several fine varieties are shipped to Cairo from another district, and early grapes from still another.

The shipment of these highly diverse products to Cairo and other valley points calls for an immense number of special crates or containers, which are manufactured with much skill and deftness from the ribs, or gerid, of the date leaves, a dozen or so of which are pruned from a tree each year. With 500,000 taxed date palms in Fayum, approximately 6,000,000 leaves must be pruned off each year. The ribs of these are equivalent, perhaps, to 3,000,000 or 4,000,000 feet of box boards, according to American board measure—a tidy little item for a small province with no forests. Further consideration of this subject will be found under "Utilization of date-palm by-products."

The pinnæ which are stripped from these ribs are bunched in neat bundles and passed to the basket makers to be woven into strong flat braid about $1\frac{1}{2}$ inches wide, to be sewed spirally into rough, serviceable baskets of about 3 pecks capacity, the general carryalls of the Egyptian fellahs.



MAP OF EGYPT AND THE SUDAN, SHOWING THE ROUTES OF TRAVEL AND THE LOCALITIES WHERE DATES WERE STUDIED



A GROVE OF SAIDY DATE PALMS IN UPPER GIZA PROVINCE

These palms are about 40 years old, growing in rich Nile bottom land near Abu Nemrus, constituting one of the finest groves in Egypt



A



B

DATE-PALM PRODUCTS AND BY-PRODUCTS

- A.—A trader's warehouse in Fayum, Egypt. A camel caravan has just arrived from Baharia Oasis loaded with "Wahi" dates—the trade name for the Saidy date. Four of the 85-pound packages make a camel load
- B.—An old Egyptian basket maker. The braid this worker is sewing is plaited from the pinne of the date leaves, and as he uses his thread he twists it between his palms from shredded date pinne and hides his stitches so deftly that it is difficult to discover where the braid is joined



A



B

BASKETS AND SHIPPING CRATES MADE FROM PALM LEAVES

A.—Market day in a village in Fayum. Baskets made from braided date-leaf pinnæ literally covering an acre of ground were sold to dealers from Cairo

B.—Shipping crates made from date-leaf midribs. These crates were used in packing date-palm offshoots shipped from Giza via Alexandria, New York, the Panama Canal, and San Pedro to the United States Experiment Date Garden at Indio, Calif. They contained an average of 20 offshoots each, weighing when packed about 400 pounds

Plate 3, *B*, shows a typical old basket sewer, who deftly twists his thread from the shredded pinnæ between the palms of his hands as he works and hides his stitches so neatly that the uninitiated can not tell how the basket is made. Plate 4, *A*, is from a photograph of a market-day scene outside a Fayum village, where literally an acre of baskets was sold to Cairo traders who had come out for the occasion.

The second pruning of the date palm takes off the broad leaf base below the gerid—a good stiff stick of fuel wood (a very precious commodity in Egypt)—and releases the thin, tough layers of the sheath, the “leef” of the natives, which is twisted by hand into 2-stranded cord, some used in reinforcing the baskets, but much of which is shipped by carloads to the valley towns, there to be worked up on crude spinning machines into all sorts and sizes of rough but serviceable cordage.

What are usually the by-products of the date tree have become of major importance. A prominent Fayum landholder frankly asserted that their seedling trees, with their outlet for the by-products, were as profitable as special varieties usually are in other districts, since the balady, or trees of the country, are more highly valued for their gerid than most of the cultivated varieties. The fruit is of course the chief item of value, poor as the dates of Fayum are; but the inferior seedling dates are all absorbed as a part of the scanty food supply of the crowded population of very poor land tillers.

LEADING COMMERCIAL VARIETIES

THE AMHAT DATE

DESCRIPTION OF THE TREE AND FOLIAGE

The following description of the tree and foliage of the Amhat variety is adapted from Department Bulletin No. 271 (12), prepared by the writer after his first journey to Egypt in 1913–14 (notes taken at Bedrashen and Abu Nemrus) :

Trees of the Amhat variety are tall—the tallest known in Egypt—and have medium-heavy trunks and glaucous blue leaves $10\frac{1}{2}$ to $13\frac{1}{2}$ feet long, with bases of moderate width and rather stout ribs strongly rounded dorsally and decidedly arched ventrally, giving unusual approach to a cylindrical cross section.⁸ The spine area is $2\frac{1}{2}$ to $4\frac{1}{2}$ feet, the medium-heavy spines from 2 to 3 inches long below to 8 or 9 inches in the upper ones and passing to stout spike pinnæ 23 to 27 inches long. The succeeding normal pinnæ are 24 to 27 inches long, decreasing but slightly till near the apex, where they drop to 20, 17, and finally 14 inches.

The pinnæ range in width from $1\frac{1}{4}$ to $1\frac{1}{2}$ inches, only a few of the apical ones dropping to five-eighths or three-fourths of an inch broad, and they are rather firm and stiff throughout, with a thickness of 0.017 to 0.020 of an inch. The pulvini are from medium to heavy, a few being slenderly caudate and coalescent.

The diversity of the angles of the pinnæ gives a rather ragged appearance to the blade, and the position of the antrorse class keeps the valley of the blade rather narrow clear to the apex, a somewhat unusual feature. The analysis shows unusually low numbers of introrse pinnæ and a correspondingly high proportion of the paired antrorse-retorse groups.

⁸ For the system of technical descriptions used in the following pages, see U. S. Dept. Agr. Bul. 223 (11).

FRUIT OF THE AMHAT DATE

Notes descriptive of a bunch of fruit purchased near Giza October 4, 1921. The bunch with stalk and strands weighed 19 okes, or about 52 pounds. (The oke equals about $2\frac{3}{4}$ pounds.)

The fruit stalk to first strands was 30 inches long and $1\frac{1}{2}$ inches broad; the slender fruiting head $9\frac{1}{2}$ inches long; shamrokh, or strands, one-eighth to three-sixteenths of an inch in diameter; proximal strands 14 to 18 inches long; apical 8 to 10 inches. The basal 8 or 10 inches of the longer strands is naked, the fruit closely crowded on the outer portion, with 25 to 32 fruits on one strand. There was a total of 64 strands on this head. These characters give the Amhat bunch a short and unusually broad outline. Most of the fruits are $1\frac{1}{8}$ inches long, a few as short as $1\frac{1}{2}$ and $1\frac{3}{4}$ inches, being seven-eighths to 1 inch in diameter. (Fig. 1.) As maturity approaches the first ripening color tones are close to a "deep honey yellow" or "Isabella color" (R. XXX),⁹ deepening to near "sepia" (R. XXIX). The color of the sun-

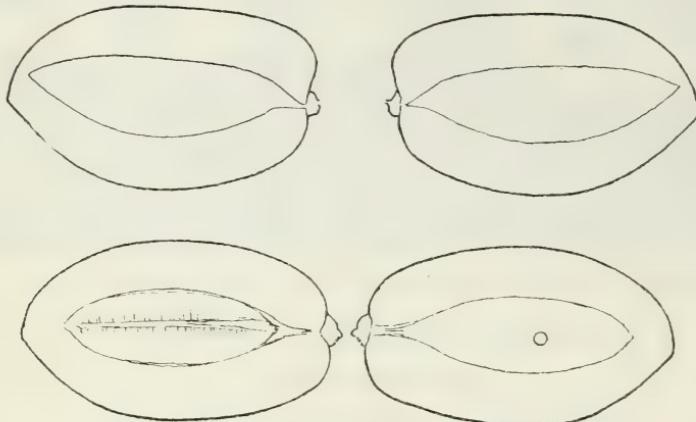


FIG. 1.—Outlines of Amhat dates in the rutab (fresh) stage from Cairo, Egypt, September 24, 1921. (Natural size)

exposed portions of stalk and strands is "ocherous orange" (R. XV). The sun-exposed fruit, mature but hard, is between "light orange yellow" and "deep chrome" (R. III). The first ripening tone is near "yellow ocher" (R. XV), but more waxy. The colors "buckthorn brown" to "Prout's brown" (R. XV) follow rapidly when there is a thick brown syrup beneath the thin, brittle skin, and the flesh is soft and luscious. The fruit ripens very gradually and unevenly, and each tree has to be climbed and picked over several times. The color of the ripe seeds is close to "amber brown" (R. III).

These dates are grown on heavy Nile bottom land. It seems likely that on sandy loam and in a hotter, drier climate—Tempe, Ariz., for example—the fruit would possess greater sugar concentration and make a successful packing date. Here (in Giza) the Amhat is the sweetest and most popular of the varieties eaten fresh, and only a small proportion of the crop is packed. It is regarded by the Giza growers as more profitable than the "Sewi," as they call the Saidy, and the shoots command a higher price. Though fresh Amhat dates appeared here about September 15, more than half the crop is still on the trees at this date, and it will last about through the month.

THE AMRI DATE

REGION OF CULTURE IN EGYPT

The culture of the Amri date, the one export variety of Lower Egypt, is practically confined to the Delta borderland on the east.

⁹ In this and succeeding color descriptions reference is made to plate numbers in Ridgway (18).

from Birket el Haggi around through Belbis, El Qurein, Facous, and Salhieh—approximately the “Land of Goshen” of the Old Testament accounts.

Apparently this variety has been cultivated and highly esteemed in this region for more than a century, for Wilkinson (22, vol. 1, p. 463) lists “Bellah Aamree from El Korayn,” and Wilkinson is cited by Martius (10, p. 259) as follows: “Balah Aamri, quae e Korain in urbes Aegyptiacas importatum.”

This strip of country gets the last Nile water on the eastern side of the Delta, and there are extensive districts where well water is developed either to supplement the canals or as the main supply. The soil generally has an excess of sand, blown in from the bordering desert, and the climate gains considerable heat from proximity to the desert dunes. The high humidity and the liability to fogs from the coast render the drying of dates rather precarious. This has led to the development of the interesting drying yards of pebbles described under “Harvesting and packing.”

DESCRIPTION OF THE AMRI DATE

[Notes made at Roma Plantation, near Birket el Haggi, October 6, 1921 (see outlines, fig. 2)]

Stalk $5\frac{1}{2}$ feet long to first strands; slender, only $1\frac{1}{8}$ inches broad at base, 1 inch at head; fruiting head 10 inches long, slender; strands slender, proximal 20 to 22 inches long, apical 14 to 15 inches long. The proximal strands are naked for 12 or 15 inches at the base. The fruits are from $1\frac{3}{4}$ to $2\frac{1}{2}$ inches or rarely 3 inches long and $1\frac{1}{8}$ to $1\frac{1}{2}$ inches in diameter, with the greatest thickness one-fourth of the length from the base, tapering to an obtuse apex. The form is irregular and generally unsymmetrical.

While these dates have considerable sweetness, they lack fine flavor and have considerable cottony rag at the center. However, their large size and attractive appearance secure a quick market for them, and London wholesale dealers state that while they last they compete with the Moroccan Taflet.

The success of this variety in a region of relatively low temperature and high humidity undoubtedly lies in the fact of its rather fibrous nature, having a sufficiently low moisture content to insure against fermentation even in this moist climate. The Amri variety may prove of importance in the more humid date regions of the United States. While distinctly second class as to quality, its packing properties, together with size and appearance, might advance it several points in the scale.

THE BARAKAWI DATE

CULTURAL EXTENSION

The planting of the Barakawi date, a valuable dry variety, has been so greatly stimulated in Dongola Province in recent years that it is now impossible to procure offshoots from the trees at any price. Upon a special request from the United States Department of Agriculture, however, in the spring of 1922, through the good offices of Sir Herbert Jackson and the kindness of the governor of Halfa Province, in which the Sukkot district is located, a special messenger was sent into that district—which, as has been shown, was probably the original home of four choice Sudan varieties—and 50 offshoots each of the Barakawi, the Bentamoda, and the Gondeila were brought down to Wadi Halfa by camel transport and dispatched to Giza.

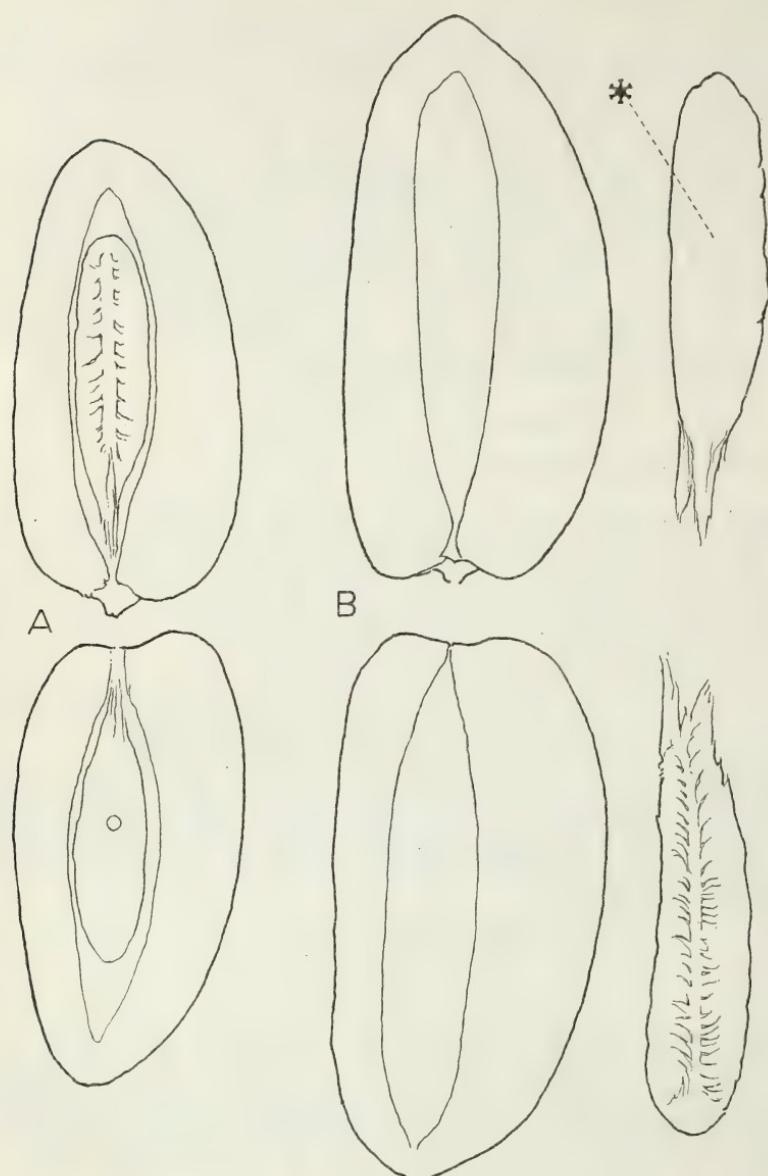


FIG. 2.—Outlines of Amri dates in the rutab (fresh) stage (natural size):
A, Normal type; B, exceptional size, from Roma plantation near Birket el Haggi, Egypt, October 12, 1921. In the outline marked with an asterisk (*) the germ pore is absent.

DESCRIPTION OF THE BARAKAWI DATE¹⁰ (SUKKOTI, IBRIMI, IBRIHIMI)¹¹

The following description of the Barakawi date, adapted from Department Bulletin No. 271 (*12*), now out of print, was prepared from notes by the writer on a journey to the Sudan in 1913.

The leaves of the Barakawi variety are 9 to 10 feet long, with a graceful feathery taper. The spine area is 18 to 24 inches, the spines slender and acute, the lower ones weak and short, but the higher ones become 2½ to 4 inches long, passing into ribbon pinnae 10 to 15 inches long, only three-eighths to one-half an inch broad, soft, thin, and acute.

The normal pinnae are 12 to 16 inches long, three-fourths of an inch to 1 inch broad, but the blade tapers with a feathery grace toward the apex, where the pinnae are but 6 to 9 inches long and one-half to five-eighths of an inch wide. The pinnae are very smooth in their arrangement, falling nearly into two ranks, with a divergence from the plane of only 10° to 30° and from the axis of 30° to 45°. The groups fall into twos, threes, and fours, but the difference in the angles formed by the antrorse, introrse, and retrorse pinnae is not very pronounced, and toward the apex many of the pinnae are difficult to place.

The pulvini are inconspicuous and none caudate.

The fruits are of the dry type, 2 to 2¼ inches long, three-fourths of an inch broad at the base, tapering acuminately to a small obtuse apex. They are usually oblique and unsymmetrical, often slightly curved. The surface is broken by fine, branching, longitudinal furrows, but is more nearly smooth toward the base. The color of the apical half or two-thirds is "chestnut brown" (*R. XIV*) or in some cases more nearly "bay" (*R. II*). There is a faint lavender bloom. The basal portion of the fruit is usually a shade between "honey yellow" and "Isabella color" (*R. XXX*).

The firm dry flesh is three-sixteenths of an inch thick, having an outer zone sometimes the color of the exterior, the inner portion being pale "cream color" (*R. XVI*) or "cartridge buff" (*R. XXX*). The flavor is moderately sweet, wheaty, with a suggestion of a fruity acid and no hint of astringency. With those who are fond of the appetizing flavor of the best dry dates without the cloying richness of the sirupy type, this will find a place among the three or four best varieties. The seeds are small for the size of the fruit, about 1⅓ inches long, one-fourth to five-sixteenths of an inch broad, nearly oblong, smooth, with a broadly rounded apex. The small germ pore is placed at about three-fifths of the seed length from the base, the ventral furrow being narrow but rather deep. In color they are "snuff brown" (*R. XXIX*) in the darker parts, fading toward "cream buff" (*R. XXX*) in the lighter portions.

This is the great commercial date of Dongola Province, and it is claimed, as for the other three varieties, that it was brought from the Sukkot country many years ago, a claim fully sustained by Burckhardt's account.

The fruit is reputed to possess the best keeping qualities of any variety known in Nubia or the Sudan. The natives say that it will keep for two years, and that it is so hard that the weevils do not get into it. It was formerly in great demand among the nomads, who came in from as far as Kordofan to purchase these dates at the Dongola market towns. The price as given by Davie¹² is 72 to 96 piasters per ardeb of 320 pounds, equivalent to \$1.12½ to \$1.50 per 100 pounds.

Col. H. W. Jackson, governor of Dongola Province, states that about one-third of the output of this date now goes to Egypt; also that they are much sought after by the pilgrims to Mecca, their fine keeping and transporting

¹⁰ The original name of this variety, as obtained from Sukkot by the Dongola people, is undoubtedly Barakawi, which in the Arabic of that province signifies "blessed," as ascertained by Thomas W. Brown, of Giza. Some of the chief men of the province, however, write the name in a form which must be transliterated "Birkawi," adjective for the noun "birka," a pond or pool. Originating in Sukkot, offshoots of the variety were carried down the river to below Wadi Halfa, where they were given the name Sukkoti. After a shipping trade in these dates from the Ibrim region below Halfa was carried on to points down the river, they took the name Ibrimi, and now the Barakawi dates going to Cairo from Dongola Province are sold under the name of either Ibrimi or Sukkoti.

¹¹ Popenoe (*16*) gives this variety as "Ibrihimi, vulgarly Ibrimi, Abraham's date," being evidently unacquainted with the geographic origin of the name Ibrimi.

¹² Unpublished manuscript, "The Date Palm," by W. A. Davie, Inspector of Agriculture, Khartum, May, 1911; courtesy of the Director of Agriculture and Forestry, Sudan Government, 1913.

qualities as well as their excellence as food making them very desirable for such a long journey. One of the prominent sheiks told the writer that these dates are sold in Egypt under the name Ibrimi.

The region of the chief production of this date is the great bend of the Nile, a stretch of about 200 miles lying between the Third and Fourth Cataracts. For the greater part the bottoms are very narrow, scarcely more than garden patches, and often the rugged sandstone bluffs, crowned with the ruins of ancient Roman fortresses or the more recent native retreats in time of river raids, rise abruptly from the river bank. There are no irrigation canals in the entire Province, and with the exception of some small flood areas and the infiltration received by trees near the river banks, the date trees are all irrigated by means of rude geared wheels of acacia wood (sakieh) turned by bullocks, which lift the water by means of an endless chain of earthen jars set on heavy ropes. Where the lands are the best and the culture the most intensive, the sakiehs are often not more than 100 feet apart, and the moaning creak of a score of these along the river bank on a hot tropical night is one of the memories that will abide longest with the visitor to Dongola.

Except in the newest plantations, there is little regularity in the setting of these date trees, and the practice of allowing from three to seven or eight "daughter" trees, offshoots from the "mother" tree, to grow up around it, inclined at various angles from the perpendicular, gives to these Dongola date plantations a weird and tropical picturesqueness which contrasts strongly with the straight-bodied, formal appearance of the groves seen about El Marg or Bedraschen.

Either there is an appreciation of the fact that in this region of dry air and intense heat a greater insulation of the growing center is needed, or perhaps the temptation to remove leaf material is not so great; at any rate the tops of the Dongola date trees are left much heavier than in Lower Egypt, and the leaves are not cut so closely at the base.

The Dongola people are apparently very well satisfied with their Barakawi industry and are offering no offshoots for sale, but are planting new groves as fast as they can get the material.

The writer was informed that there is also a considerable production of this variety, under the name "Ibrimi," in Berber Province, which is the uppermost date-producing region of the Nile Valley, including the Fourth and Fifth Cataracts; for while there are many date trees about Khartum, the fruit is produced hardly in commercial quantities.

In the reaches of the Nile Valley between Wadi Halfa and Korosko there are narrow stretches of alluvial land and islands which, together, permit the cultivation of many thousands of date trees, of which this variety, under the name "Ibrimi," is the chief. An important section of the valley is on some maps designated as Wadi Ibrim, to which an ancient ruin known as the Kasr Ibrim doubtless gave the name. This is now represented by a modern native village of the usual squallid type. The product of this section reaches the markets of Lower Egypt under the name of "Ibrimi," and often leads to the inclusion of the Barakawi dates from Dongola under the same name. As there is a great variation in size and appearance among the dates marketed as "Ibrimi" in Cairo, there is good ground for the suspicion that the crop from a good many seedling trees bearing fruit closely resembling the original variety is marketed under that name. This suspicion was confirmed by the testimony of several prominent growers in Dongola Province.

MARKETING BARAKAWI DATES

An average of about 4,000 tons of dry dates are shipped annually from the Sudan to Egypt through the port of Halfa. Most of these are of the Barakawi variety, but they are so frequently mixed with "gaowa" (seedling) dates resembling it that the Sudan office of commercial intelligence makes use of the term "Barakawi quality" in its market quotations. The greater volume of the Barakawi dates goes to the great native town of Omdurman, at the junction of the Blue Nile with the White Nile. The number of trees of this variety in the Sudan is estimated at about 500,000 (*14, p. 57*).

The Nile post steamers on the Dongola reach, between the Third and Fourth Cataracts, tow many barge loads of this date to Karima, whence they go by rail both to Halfa and to Omdurman. There is also a heavy camel traffic from points on the big bend of the Nile across the mountains direct to Omdurman.

THE BENTAMODA DATE

VARIETAL CHARACTER COMMERCIALLY CONSIDERED

In number of trees and volume of fruit production the Bentamoda variety (the Bartamoda of Upper Egypt) occupies a minor place among the commercial dates of Egypt and the Sudan, but its superb character as a dessert fruit, with its admirable keeping and shipping qualities, entitle it to a high place among the world's finest dates.

Why it has remained so long in so obscure yet so distinguished a position (for it is most highly esteemed among those who know it) is one of the conundrums of the date industry, with the possible answer that it may lack in productive capacity to a degree that would make its culture commercially unprofitable. Mere commercial inertia seems to be a more probable explanation.

To illustrate: In two private gardens in Upper Egypt there are growing to-day two seedling date palms, each producing fruit in size, flavor, and shipping qualities fully equal to the far-famed Deglet Noor of Algeria, yet both of these trees have passed the offshoot-producing stage without an offshoot having been planted from either. Each owner has been content with the possession of a choice date within his walled garden.

The Saidy, for more than a century the prize date of a brisk commerce between the Libian oases and the Nile Valley, until American recognition has scarcely been seen beyond Cairo, yet the Deglet Noor, with probably a later origin as a seedling, has become the most highly prized commercial date of the world. It is entirely possible that the Bentamoda, after its seclusion of more than a century, may yet find its place among the fine dates of the world's commerce.

DESCRIPTION OF THE BENTAMODA (BARTOMODA) DATE

The description of the Bentamoda date, adapted from Department Bulletin No. 271(12), follows:

Trees of the Bentamoda variety have moderately heavy trunks and gracefully curved leaves 9 to 12 feet long, with light, slender ribs and narrow bases. The spine area is very short, the slender needlelike spines being from 1 inch long below to 5 or 6 inches in length where they pass to the narrow, grassy ribbon pinnae. The normal pinnae range in length from 12 or 16 inches to 18 or rarely 21 inches at a little beyond the middle of the blade, holding 12 to 16 inches to near the apex, where they shorten abruptly to a range of 7 to 10 inches.

The pinnae are narrow throughout, seven-eighths of an inch to 1 inch broad, rarely exceeding 1½ or 1¾ inches in the wider ones. Their texture is soft and grasslike, with a thickness of 0.011 to 0.014 of an inch. The pulvini are light, in some cases slightly caudate, but with no groups coalescent. At the base of the blade the pinnae have a light axial divergence and a strong divergence from the blade plane, forming a narrow, close valley, which opens out toward the middle of the blade, where the pinnae are at about 27° to 30° from the blade plane, giving a rather smooth uniform leaf toward the apex. The general color is rather light green, with a thin waxy bloom.

The fruit in ripening presents a very beautiful appearance, the bunches being heavy on long strands (shamrokh). The half-ripe fruit is about $2\frac{1}{4}$ inches long, often oblique, a little curved, and with a peculiar long-pointed apex. The color is a mingling of "apricot orange" (R. XIV) and "ochraceous orange" (R. XV). The flesh is thick, its interior being a satiny white. In ripening, the fruit becomes considerably reduced in size, and is about 2 inches long and seven-eighths of an inch to 1 inch broad, with the skin softly wrinkled and an appearance of bloom. The color is now a shiny "Brussels brown" (R. III). The oblique form and long point are still well retained. The flesh is soft but not sticky, very rich and sweet, with a distinctive flavor which places it in a high class among dates. The smooth oblong seed is narrow and rather delicate for the size of the fruit, being $1\frac{1}{4}$ to $1\frac{5}{8}$ inches long, five-sixteenths of an inch broad, rounding about equally and obtusely at either end; but the apex is often apiculate. The germ pore is placed about two-fifths of the seed length from the apex, the ventral furrow being shallow and narrow. The color of the seed is close to "Sayal brown" (R. XXIX).

Samples of this fruit brought from Merowe and examined in Washington, D. C., on May 20 of the following year, though still in perfect condition, did not possess quite the high flavor of the recently matured fruit.

This variety is considered by the English residents of the Dongola and Halfa Provinces to be the finest date of dessert quality in the Sudan. It is nowhere found in commercial quantities, and the possession of a few trees is regarded as rather a mark of wealth and distinction, the fruit being kept to offer to guests or sent as presents. The gift of an offshoot from this variety is a mark of especial favor or courtesy. Davie¹² states that this variety "can be treated as a soft or a dry date," also that "an ardeb (300 to 320 pounds) will fetch as much as 192 piasters (\$9.62 in American money). There is not much trade in this variety, however, as the quantity is limited." It is claimed to be one of the four varieties originally obtained by the Dongola people from the Sukkot region, where it is to be found to-day in greater numbers than in Dongola.

A very interesting question of synonymy arises from the fact that among samples of dates collected from near Aswan for Thomas Brown, horticulturist, of the Egyptian Ministry of Agriculture, was one of a variety called Bartamoda, which upon careful comparison could not be distinguished from the sample of Bentamoda which the writer brought from Merowe. Also, in October, 1911, Mr. Aaronsohn, acting as agent for Mr. Fairchild, of the United States Department of Agriculture, purchased at Aswan, among others, 10 offshoots of "Bartamoda" (under S. P. I. No. 32720).

As offshoots have been brought down the river from Sukkot to the Aswan region for many years, it would have been probable that so fine a variety as the Bentamoda would be among them, and with the carelessness of these people about names, which often pass by word of mouth, the discrepancy in this case is not surprising. As to the meaning of the name as used in Dongola, the writer could get no satisfactory explanation. To the question whether it was from "bint" or "bent" (daughter or girl), they insisted that it was neither.

A special trip to Aswan was made early in February, 1914, for the purpose of studying on the ground the question of the identity of the dates known under these two names. A close examination was made of the few trees known as Bartamoda to be found near the village, and through the courtesy of the omda samples of the fruit were obtained, so as to settle beyond question the identity of the two. A very intelligent native gardener, familiar with the trade in date offshoots from the Sudan region, also emphatically testifies that Bentamoda and Bartamoda are the same date.

See also the notes on this variety under "Upper Nile varietal date region" (p. 7) and illustrations in Department Bulletin No. 271 (12, p. 22, pls. 6 and 7).

THE HAYANY DATE

REGION OF CULTURE

The Hayany is the most extensively planted and most important commercial date variety grown in Lower Egypt. It extends along

¹² See footnote 12 (p. 13).

nearly the entire Mediterranean coast of the Delta, and after a wide break above Port Said it appears in considerable numbers at El Arish, at the mouth of Wadi Arish, near the frontier of Egyptian territory toward Palestine. According to Popenoe (16), it is grown commercially at Ghuzzeh (Gaza) in southern Palestine, near the coast.

Its culture extends southward along either Delta border as far as Cairo and Kerdaseh. Trees at the latter place are said to be more than 100 years old. In upper Giza Province the groves are younger, and the culture is recently being considerably extended along the warm sandy border lands toward the desert.

In propagation the Hayany is one of the most prolific of all date varieties, not only producing numerous offshoots around the base of the young trunk but continuing to put them out for several feet up the trunk, so that it is often found necessary to cut them off while young so that they may not interfere with the fruitfulness of the tree.

Though the offshoots of this variety are usually small, they are hardy and easily established.

A rather small palm, both in height and in trunk diameter, it yet makes a rapid growth as a young tree. (See notes under "Comparative height of Egyptian date palms.")

Its leaves are feathery and graceful, making this one of the most beautiful varieties of the date palm in cultivation, well worth a place in any dooryard as an ornamental alone.

The beauty of the regular rows of these palms is greatly enhanced by the attractiveness of the heavy crops of fruit.

The slender fruit stalks, 3 or 4 feet long, carry the heavy, compact bunches of fruit well outside and below the crown of leaves. The complete circle of bunches of the brilliant carmine fruit, suspended from the vaselike crowns of feathery leaves, combine with them to form capitals for the regularly sculptured columns of the trunks, making on the whole a structure which is seldom surpassed for beauty (pl. 5, A).

Much valuable light is thrown on the early history of this variety in the great work of Martius (10, vol. 3, p. 259) in which he quotes from Raffeneau-Delile (17, p. 78), mentioning 10 "subvarieties" of Egyptian dates, among them the Hayany with the explanation, "nomine proprio viri cuiusdam Hayan appellatum" (proper name of a man who was called Hayan).

As Raffeneau-Delile visited Egypt in 1778 and the years following, this is invaluable information as to the early origin of this widely distributed and popular variety. Here is also probably the correct explanation of the origin of the name, the only explanation known to the writer. The date of Raffeneau-Delile's notice of the Hayany variety agrees well with the reputed age of these trees at Kerdaseh, referred to on another page.

Wilkinson (22, vol. 1, p. 463), in a list of agricultural products of Egypt, states:

The dates sold in Egypt are of several kinds, some being native and some imported from other countries. The most common are—[Here follows a list of 6 varieties from "Seewee" Oasis and a general list of 16 varieties, mostly Egyptian, comprising "Aamree," "Amhat," and "Samanee," and also "Hyanee from Birket el Hag."]

The Hayany is one of the 30 varieties listed in 1871 by Delchevalerie (5), who also mentions Amhat, "Semany," and "Bent A'yeh" (modern Bint Aischa), all popular varieties for the rutab trade to-day. Probably these are all seedlings of the region. Delchevalerie gives fifth in his list of 30 Egyptian varieties "Balah Hayany," about which he probably knew nothing, because he states that "these dates derive their name from their village in Upper Egypt" and affirms that they are highly esteemed in that country and that they are made into "a kind of paste," probably "aguia."

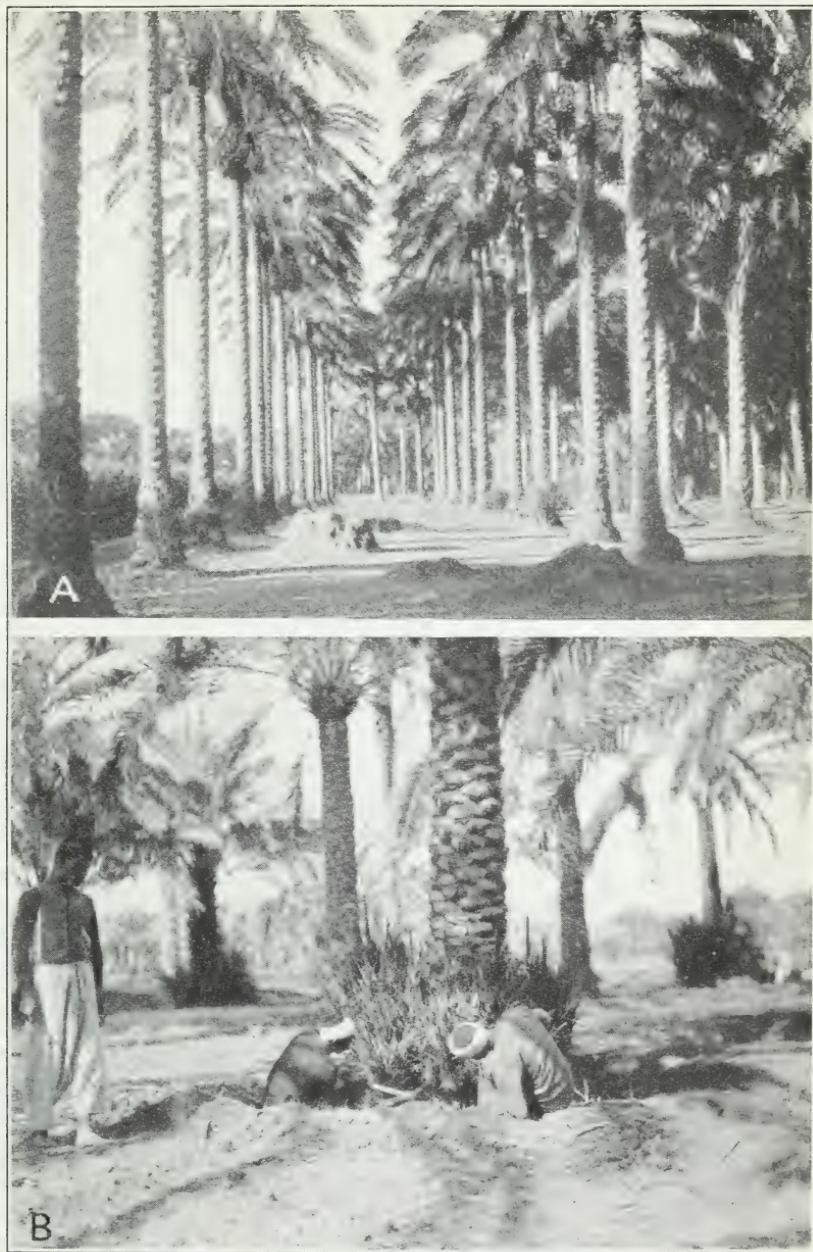
INTRODUCTION INTO THE UNITED STATES

Delchevalerie's No. 30, however, is "Balah Birket el Haggi," or the date from the "Pool of the Pilgrims," and it was under this name that the Hayany variety was introduced into Arizona in 1901, under S. P. I. No. 7635, through Mr. Fairchild, of the United States Department of Agriculture (21).

It appears that introductions under S. P. I. Nos. 6438 and 7635 were of the normal type of Hayany, though the name "Birket el Haggi" given it by Delchevalerie was somehow picked up by the Greek merchant Zervudachi and persisted in Arizona for a number of years, until the final clearing up of the matter in Department Bulletin No. 271, wherein the writer (12) gives an account of the early introduction of the Hayany variety in Arizona, of which the following is an adaptation:

The earliest introduction of this variety into the United States was through David Fairchild. The shipment was from Alexandria, Egypt, in the spring of 1901. Two offshoots with this name, under S. P. I. No. 6438, were planted in the Cooperative Date Garden at Tempe, Ariz. Of the same shipment one tree, labeled "Dakar Majahel," S. P. I. No. 6442, was very tardy in flowering, but finally proved to be Hayany or a near equivalent. Of a shipment of offshoots secured through Mr. Fairchild from Mr. Zervudachi, in October, 1901, six trees were labeled "Birket el Haggi" and were planted at Tempe, under S. P. I. No. 7635. Three other trees of the same lot, from which the labels had been lost, were planted without S. P. I. numbers and as soon as they fruited were identified as being the same as those under No. 7635.

Studies made by the writer from 1909 to 1912 established clearly the identity of these "Birket el Haggi" trees with the trees labeled Hayany, and probably also of the No. 6442, though its very tardy fruiting is not characteristic of the variety. The variety has been a vigorous grower, prolific in offshoots and productive of a fruit which, if not of the highest quality, contains more sugar than it develops in Egypt. It has been very popular with the people of the Salt River Valley. It soon attracted rather widespread notice and has been more highly indorsed by the staff of the Arizona experiment station as a variety likely to be more profitable under their conditions than any other date tested in the Tempe Garden. All this exploiting has been under the name of "Birket el Haggi," frequently shortened to "Birket," as more convenient and euphonious. It was natural, then, to wish to learn not only the correct name of this date, but its home in Egypt and under what conditions it grows to the best advantage. The only published reference to the "Birket el Haggi" as an Egyptian variety is in the paper by Delchevalerie (5), a former gardener of the khedive, who described it as a very rare variety, "sweet and sugary and of a reddish color," and called it "the earliest fruiting date tree in all Egypt," giving fruits from the second year of planting. Repeated visits by the writer to the villages of El Marg and Birket el Haggi, near the shores of the old "Pool of the Pilgrims," brought out the fact that they have no date variety called "Birket el Haggi," but that the early-ripening Hayany dates reach the Cairo market under this local name, as we in America speak of "Chautauqua grapes" or 'Riverside oranges.' That in a foreign country and with a foreign tongue such a local designation should



TWO VARIETIES OF DATE PALMS

- A.—A garden of Hayany date palms at El Marg, Egypt. These trees are about 50 feet high and are supposed to be 40 years old. Note the beautiful regularity of the closely pruned columnar trunks
- B.—A Saidy date palm more than 20 years old. This hedgelike thicket of offshoots of various ages and sizes surrounding the tree has resulted from the browsing of stock upon the offshoots



DATE PALMS BEFORE AND AFTER PRUNING

A.—Choice date palms in a formal palace garden. These avenue trees growing near Giza show the Egyptian system of high pruning. Two trees of the Zagloul variety in the foreground are loaded with fruit. Trees of the Samany variety are also shown

B.—The same avenue of palms shown in A after pruning

be mistaken for a varietal name is easily understood. Delchevalerie's description of "Birket el Haggi" is meager in details, but corresponds well with Hayany, though his account of Hayany in the same publication is wholly in error. How he should have overlooked the real Hayany, the most numerous and popular date in the Egyptian Delta, is difficult to understand.

The essential points are that there is no such date variety as "Birket el Haggi," and that the trees received from Mr. Zervudachi under that name and planted in the Tempe Garden under S. P. I. No. 7635 are Hayany, identical with those of the earlier importation by Mr. Fairchild under S. P. I. No. 6438.

SATELLITE TYPES OF HAYANY DATE PALMS

Delchevalerie was doubtless describing one of the many "satellite seedlings" of the Hayany referred to later in this bulletin, which it is impossible to identify at the present time.

Popenoe (16, p. 223) gives an excellent account of this date as grown at the Cooperative Date Gardens at Tempe, Ariz., under the name "Birket el Hajji" (instead of "Haggi," the Egyptian rendering), faithful to the idea that he must correct all local date names to conform to his ideas of the "classical form" of Arabic, but gives "Hayani" as a synonym and evidently takes the most of his Egyptian information from Delchevalerie.

In 1921 the writer saw Hayany trees in the village of Kerdaseh, directly west of Cairo, that were said by the omda of the village to be "more than 100 years old."

Although the Hayany may be assumed to be one of the older varieties of the Delta region and exceeds all others combined in the number of trees, a critical examination of the fruits shows variations beyond what could be due to soil conditions or culture. Fruits were noted by the writer varying from $1\frac{1}{8}$ to $2\frac{3}{4}$ inches long and with marked variations in the position of the germ pore, usually a good varietal character. In general characters of the trees, leaves, and color and texture of the fruit the Hayany characters were well retained. The conclusion can hardly be avoided that numerous Hayany seedlings have appeared, near enough like the parent to be included with the variety commercially. The term "satellite seedlings" may not be inappropriate for these.

Descriptions of some of the most marked of these satellites follow that of what seems to be the normal type.

LARGE-FRUITED OR NORMAL TYPE

A bunch of dates weighing about 50 pounds was purchased September 26, 1921, one-half mile north of El Marg Railway station. The descriptive notes were as follows:

Fruiting stalk 36 inches long to first shamrokh, 2 inches broad at base, $1\frac{1}{4}$ inches at first shamrokh; fruiting head 17 inches long, carrying 79 strands, the longest 20 to 22 inches long; the proximal 8 to 12 inches, without fruit. From 12 to 22 fruits were borne on a strand. The fruits were rather uniformly from $2\frac{1}{4}$ to $2\frac{3}{4}$ inches long, or rarely $2\frac{1}{2}$ inches long, and 1 to $1\frac{1}{8}$ inches in diameter.

The color is clear "carmine" (R. III), ripening to "dark livid brown" (R. XXXIX), but quickly passing to "dull violet black" (R. XLIV). A thin violet bloom is characteristic.

Figure 3, A, shows the more common size in outline; B, the extreme size.

SMALL-FRUITED TYPE

Near El Marg, besides the normal type of Hayany, a smaller fruited type occurs in considerable numbers.

On September 26, 1921, the writer purchased a full bunch, weighing about 20 okes, or 56 pounds (the oke is equivalent to 2.82 pounds),

of which the following description was made:

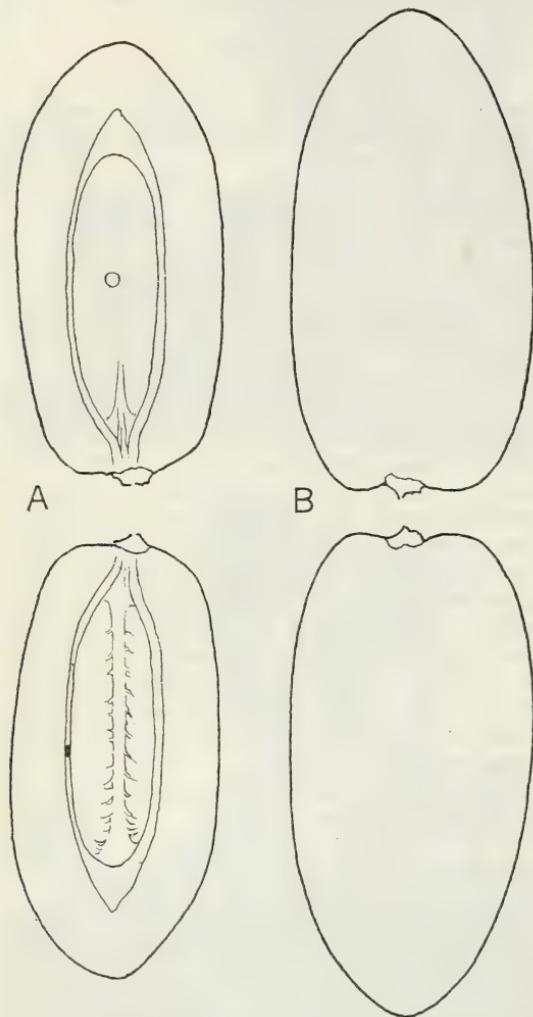


FIG. 3.—Outlines of normal large-fruited types of Hayany dates from El Marg, Egypt, September 26, 1921 (natural size): A, Common size; B, extreme size

A good deal of the fungus *Graphiola phoenicis* was present on the foliage, which is an excellent humidity index. This small-fruited type of the Hayany appears to be more than usually susceptible to humid conditions, possibly on account of the more crowded structure of the bunch.

Figure 4 shows the exact-size outlines of two typical fruits of this small-fruited type of Hayany dates, with their seeds.

The fruiting stalk to the first shamrokh is 36 inches long, breadth 2 inches. The fruiting head is 15 inches long and bears 75 strands, or shamrokhs, which are one-eighth to three-sixteenths of an inch in diameter. The proximal strands on the head are 25 to 28 inches long, the distal ones 15 to 16 inches long.

At the proximal end 12 to 14 inches of the long strands are without fruit. The longer strands bear 25 to 30 fruits each.

The color of the fruiting stalk and shamrokh is close to "capucine yellow" (R. III).

Most of the fruits are $1\frac{3}{4}$ to $1\frac{1}{2}$ inches long, 2 inches being the extreme length and 1 inch the usual diameter.

The color of the fruit is pure "carmine" (R. I.), with occasional longitudinal streaks of a darker shade and with a clear lilac bloom over all the undisturbed surfaces. The ripe color is "dark livid brown" or "seal brown" (R. XXXIX), but less brilliant than either. When ripe the skin slips readily on a thin layer of sirup, beneath which the flesh is rather mushy.

There were many ripe fruits in the bunch among those still hard, and some from the inside were overripe, soft, and moldy.

This El Marg locality is a bad one in respect to high ground water, as well as high humidity, with night dews and fogs.

Within 100 yards of where the above-described specimens were collected there were many trees of what appears to be the normal type of the Hayany, with fruits up to $2\frac{1}{2}$ inches in length, which seemed to be suffering but little from the humid conditions.

LARGE, LATE-RIPENING TYPE

As late as October 11, 1921, when nearly the entire Hayany crop of the El Marg and Birket el Haggi districts had been marketed, a large basket of dates, apparently Hayany, was brought into El Marg from some distance back in the country. This fruit was still in the characteristic rutab condition, hard and brittle, with the true carmine coloring. Its striking size at once arrested attention, and two of the largest specimens were selected for description, which follows:

The larger fruit was $2\frac{3}{4}$ inches long, $1\frac{1}{8}$ inches broad, strikingly oblique. The large, coarsely corrugated seed had a broad shallow ventral furrow, but with the germ pore wholly wanting (fig. 5, A). The second specimen (fig. 5, B) was $2\frac{1}{2}$ inches long, $1\frac{1}{4}$ inches broad, and quite symmetrical, with a smoother seed, but again with the germ pore wanting, a characteristic which has occasionally been noted in other varieties.

A LATE-RIPENING FORM FROM ALEXANDRIA

[Notes made at El Marg, December 7, 1913]

In El Marg, the center of one of the most important Hayany-producing districts of Egypt, but with the trees long since cleared of their crop, these dates were found in the market, just in from Alexandria. In contrast, Hayany dates from El Marg, probably grown at Birket el Haggi, Alexandria, September 2.

Representative fruits of the lot above noted were described as follows:

Fruit 2 to $2\frac{3}{8}$ inches long, 1 to $1\frac{1}{8}$ inches broad, the broader portion a little nearer the base (some fruits slightly unsymmetrical and curved), the taper toward the apex gradual and the apex broadly rounded. The unripe or rutab color is a dull "carmine" or close to "nopal red" (R. I), with blotches like "ox-blood red" (R. I). In ripening, the color drops through a shade near "Hays maroon" (R. XIII) to a dull unattractive brown, nearly black, but nearest to "seal brown" (R. XXXIX) or "aniline black" (R. L).

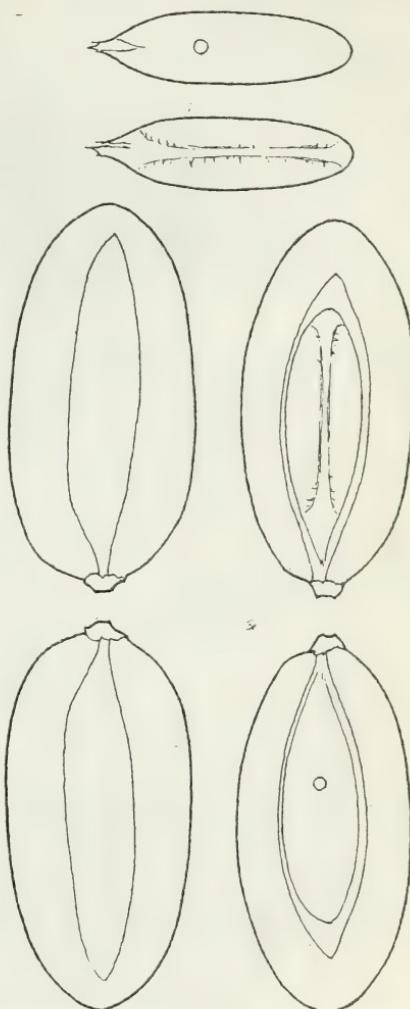


FIG. 4.—Outlines of small-fruited types of Hayany dates from El Marg, Egypt, September 26, 1921. (Natural size)

were observed in the bazaars of

With the thick, loose skin removed, the soft, sticky flesh of the ripe fruit presents a "tawny olive" color, shading within to near "colonial buff" (R. XXX).¹⁴ The interior flesh is firmer than the

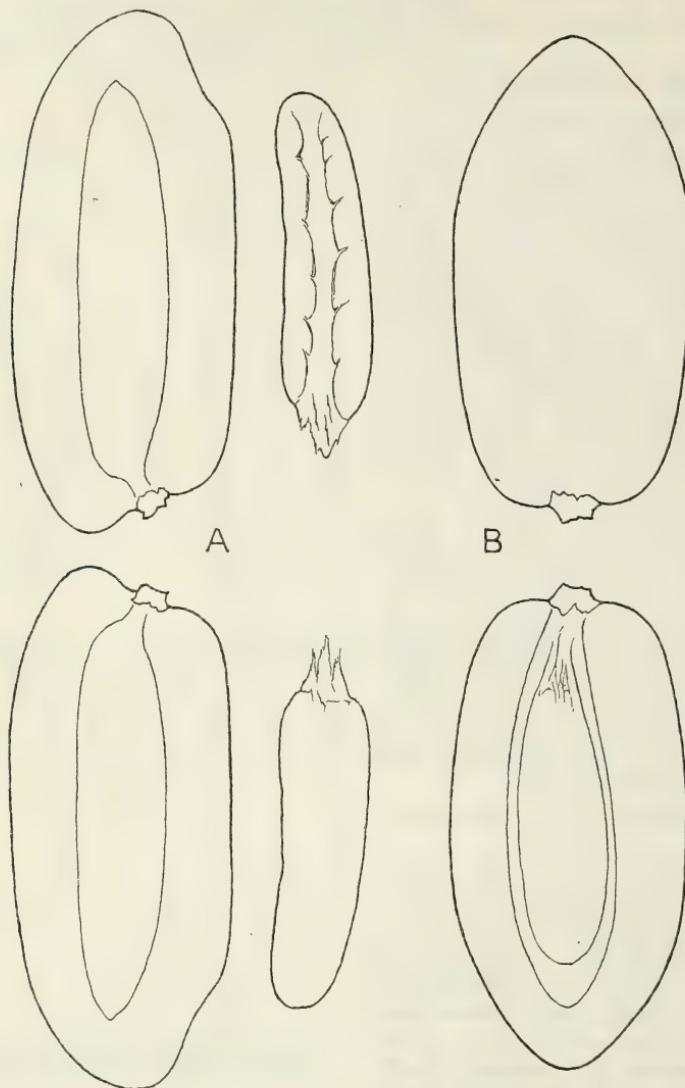


FIG. 5.—Outlines of large-fruited late types of Hayany dates from El Marg, Egypt, October 11, 1921. (Natural size)

outside, but still rather soft and fibrous, the whole thickness being about one-quarter inch.

In the rutab stage this date is juicy, crisp, mildly sweet, with little astringency. Ripened, it is moderately sweet, not cloying, but lacking in fine flavor or distinctive bouquet.

¹⁴ With the Hayany as grown at Indio, Calif., after being packed three months, the entire flesh, about one-eighth inch thick, becomes close to "seal brown" in color.

The seed is large, nearly oblong, but with a slight taper from base to apex, and often a little recurved. The ventral furrow is both broad and deep. In the seeds of this lot, as well as in a lot recently observed in the Cairo market, the germ pores are generally about one-fourth of the seed length from the base. This is an interesting variation from the usual type of Hayany, in which the germ pore is placed centrally, or nearly so. As the position of the germ pore is a rather constant varietal character, a seedling of the Hayany otherwise very close to the true type is probably indicated.¹⁵

The variation in the time of ripening of the Hayany variety in the El Marg and Birket el Haggi districts on the whole seems to be greater than can be explained by the differences in soil and water supply and strengthens the conclusion that the Hayany variety includes several distinct strains, probably of seedling origin. Similar variations have been reported from different parts of the Delta of the Nile.

Brown (3) gives for Hayany date palms in various parts of Lower Egypt the fresh yield weights shown in Table 1, being the average of a number of trees chosen at random at the places mentioned.

TABLE 1.—*Yields of date palms of the Hayany variety grown in certain localities in Lower Egypt*

Locality grown	Average yield per tree (pounds)	Average weight of bunch (pounds)
Damietta.....	233	29
Sanania	176	30
Rosetta.....	287	48
Kerdaseh.....	365	37
El Hawamdiya.....	366	33
Giza.....	122	12

The highest yield of a single tree included in Table 1 was that of a specimen which bore 490 pounds at El Hawamdiya, where the soil is a rich black loam. The low yield of the trees at Giza is accounted for by the fact that they were intermingled with other trees, such as guavas. The palms at Sanania were growing on salty land. Those at Rosetta and Kerdaseh were on sand, well cultivated.

PRESERVING THE HAYANY DATE IN EGYPT

In Egypt it is fully recognized that the Hayany is not a packing date. While Saidy, Amri, and some Amhat are packed, the Hayany fruits are seldom prepared in this manner. The usual method practiced by the Egyptian people to preserve them beyond the fresh stage is that of making agwa, their favorite treatment of several soft, sirupy varieties. To accomplish this the fruits are spread on the ground on matting or on the pebble-laid drying yards until well ripened, when there will be a sirupy layer between the skin and the flesh. At this stage the skin is readily slipped with a

¹⁵ Outline figure of this date and seed appeared as Figure 6, Department Bulletin No. 271 (12).

little pressure from the thumb and finger, and the seed can either be squeezed out or released with the sharp point of a knife.

Then follows the process of breaking up the texture of the date and working the whole mass into a homogeneous paste. This is then spread for a while in the hot sun and again worked over. It is finally firmly packed in unglazed earthen jars, called "zeras," of 2 or 3 gallons' capacity, a piece of cotton cloth placed over it in the neck of the jar, and tightly sealed with wet clay. If a number of insanitary features in connection with these operations could be eliminated, there is no doubt that the product would be a tooth-some one. The process of ripening for some time in the air-tight jar improves the quality.

Among the California date seedlings there are many with rich, sweet fruit of such a soft and sirupy character that they are difficult to handle in the ordinary way in carton or basket shipments. There would seem to be an opportunity to develop an American form of agwa, prepared by scientific and sanitary methods, which would commend itself to the discriminating American housewife.

The Hayany date is used to a limited extent by the foreign population of Egypt for various forms of preserving and canning. To remove the seeds from the fruit in the fresh stage and to replace them with pistache kernels is a favorite method. The dates are then cooked in sugar sirup and canned as fruit is commonly canned in this country. A solder-sealed tin can of Hayany dates prepared in this way was brought to Washington, D. C., by the writer and found to be a very delicious treat after keeping for more than two years. (See also "Harvesting the Hayany date," p. 50.)

THE SAIDY DATE

The Saidy variety, intrinsically the most valuable date of Egypt and numerically only second in importance, if the plantations of the Libian oases as well as those of Giza Province are included, has been so fully described in its technical characters in Department Bulletin No. 271 (12), in part reprinted, with a full historical account and a climatic appraisal, in Department Bulletin No. 1125 (13) issued in February, 1923,¹⁶ that further description at this time seems unnecessary. But later observations in Egypt, as well as acquaintance with the behavior of trees of the earlier importations of this variety to California and Arizona, reveal important points yet unrecorded.

ORIGIN OF THE SAIDY VARIETY

The origin of the Saidy variety (called Sewi or Sewah in Giza Province) has been a matter of some speculation, this variety having been so long in cultivation in the five Libian oases that evidence regarding its source has been lost. The name Saidy (or Saidi) suggests an Upper Egyptian origin, and Abu Bakr, omida of Rashida Village, of Dakhla Oasis, suggested to the writer in a conversation in October, 1913, that the date might have come from the Said, or Upper Egypt, a long time ago. Popenoe (16, p. 279) makes the

¹⁶ This bulletin may be procured from the Superintendent of Documents, Government Printing Office, Washington, D. C., price 15 cents.

same suggestion. It is only recently that any more definite information has come to light. C. D. Belgrave (*i*, p. 95) gives the following very significant narrative:

According to the old history, which is preserved at Siwa, there was another small incursion from the east at a later date. About the middle of the fifteenth century there was a great plague which carried off a number of Siwans. A certain devout man in Egypt dreamed that the ground at Siwa was very rich. He came to the oasis and settled there, planting a special kind of date palm which he brought from Upper Egypt; he also grew dates for the "Wakf" (religious foundation) of the Prophet, which custom still continues. Later, he made the pilgrimage and described the country of Siwa to the people of Mecca, who had never heard of it. They did him great honor. He returned to Siwa accompanied by 30 men, Berbers and Arabs, who settled in Siwan. They built an olive press in the center of the high town and inscribed their names thereon. From these men and their Siwan wives certain of the present inhabitants are descended, and some Siwans boast to-day that their forbears came with "the Thirty" whose names were inscribed on the old olive press.

The date men of both Egypt and the Sudan have always been prone to give local names to date varieties, as, for example, calling the Saidy the Sewi when it was brought from Siwa Oasis to the Giza district opposite Cairo. Another example is found in the fact that offshoots of the Tunisian Deglet Noor were introduced into Dongola Province in the Sudan by Gov. H. W. Jackson about 1911. A number of survivals of this importation are now known among the natives as the Tunisian date, the name Deglet Noor having entirely disappeared.

Nothing would be more natural than that the "special kind of date palm" which "a certain devout man" * * * "brought from Upper Egypt" should become known as the Saidi, or date from the Said. Caravan communication between the five oases of the Libyan Desert was common from very remote times. It was but natural that the culture of this new date from the Said should spread to the whole group, as we find it at the present time.

CONFIRMING THE INTRODUCTION OF THE SAIDY DATE INTO EGYPT FROM THE SIWA OASIS

In Department Bulletin No. 271 (*12*) the close resemblance and probable identity of the Sewi date of Giza Province with the Saidy of the five Libyan oases were pretty well established and by repeated testimony placed beyond question in Department Bulletin No. 1125. It was also shown that the introduction of the Saidy into Egypt dated back a considerable time, in the opinion of older men of Kerdaseh, 100 or perhaps 150 years.

Notes were obtained in the district adjacent to Cairo on the west, as well as in upper Giza, in 1921-22, which were not put in shape in time to appear in Department Bulletin No. 1125 (*13*), but which throw important light on the age of the "Sewi" date culture in Giza Province.

The "Sewi" territory may for convenience be divided into the district north of the boulevard leading to the Great Pyramids and that south of it. North of the pyramids a long narrow strip lying between the drainage canal and the desert bluffs, with Kerdaseh as its official center, contains, according to the omda of that village,

about 20,000 "Sewi" (Saidy) palms. Of these but a few are placed as "more than 100 years old." Most of them would not exceed 40 or 50 years. This is a territory of rather lean, sandy land, chiefly given to date culture, and trees of the Hayany and Amhat varieties greatly outnumber those of the Saidy.

Between the drainage canal and the Nile the country has abundant canal irrigation, and the soil is heavy, generally fertile, and devoted to field and orchard crops, date trees being only incidental. Most of the villages have groves of tall and striking old palms, mostly Amhat, but with a small number of Saidy, not on an average more than 10 per cent. El Maatemdiyah has the most, and the owners assert that their old trees are older than those of Kerdaseh. Here also some younger plantations have been made, but the total number is not more than 25 per cent of the whole.

El Baragil, farthest north, Mit Ukbeh, not far from old Bulak, and Saft el Leben all have small groups or scattering trees of Saidy of great age, mingled with the much taller Amhat, invariably said to be of about the same age—80, 100, to 120 years. With many of the older trees there was a distinct falling off in fruit production, which was especially to be noted in the more salty ground.

Crossing the pyramid boulevard, the notably tall palm groves along the river front are nearly all Amhat, with a few scattered specimens of Saidy. The first considerable garden of the latter variety, 15 or 20 years old, is at Esbit Monib.

At Tamweh a few trees of Saidy were 50 to 60 years old, two doubtfully 100 years old. At Umm Khanan, in a mixed plantation of Amhat with about 30 per cent of Saidy, the trees were estimated at 60 years, this apparently being the pioneer older planting of the date from Siwa Oasis on a commercial scale. The incentive to this may have been a few fine old trees, two of which were 60 feet and 61 feet 10 inches high, respectively (the highest yet recorded), and were estimated by their owner to be 120 years old.

Around the thriving village of Abu Nemrus (pl. 2) are some of the finest date-palm groves in the entire Province, from 10 to 30 or 40 years old, in which the Saidy largely predominates. Really old Saidy trees were not seen, but a few were found that would pass the claim of being 80 years old.

El Hawamdiya again has some of the finest date trees in the valley, with two champion Amhat trees, 90 feet 7 inches and 92 feet 5 inches high, respectively. With these were a few Saidy which were said to be the same age—120 years. Here, as at Abu Nemrus, the important commercial area is composed of gardens from 15 to 30 years old, but with the Amhat trees rather more abundant than the Saidy.

From Bedrashen to Mit Rahineh, a country which was largely occupied by the site of ancient Memphis, is another of the important date-growing districts of upper Giza Province. The land immediately west and north of Bedrashen is occupied by thrifty young plantations from 10 to 30 or 40 years old (pl. 9, *B*), in which the Saidy variety largely predominates over the Amhat.

Farther to the west is an irregular strip with a north and south extension, lying too high for irrigation from gravity canals and at present badly watered. Here, surrounding the three great statues

that testify to the former grandeur of Memphis, growing upon the débris of her buildings, and shading a few poor hovels of the present inhabitants, are several thousand Amhat palms of very great age. Among them, perhaps not a hundred in all, are Saidy trees which appear equally venerable. That they are 130 years old may be doubted, yet some of the Saidy palms measured 45 feet to 51 feet 10 inches, with Amhat 66 to 67 feet, and better nourished ones nearer the water 75 to 76 feet.

Growth would, of course, be much slower than on the rich, well-watered bottom lands of Abu Nemrus and El Hawamdiya.

These Memphis trees looked older than any other trees seen in the province, and here doubtless was the site of one of the original introductions of the Saidy date from Siwa Oasis into the Nile Valley, and probably the source of distribution to all this upper Giza country.

Briefly, then, scattered well over Giza Province are found little groups and single trees of the Saidy date palm—which the people consistently call “Sewi”—trees of extreme age which the owners affirm are more than 100, 120, and even 130 years old.

These might easily be the offspring of a few “shettla” brought at a still earlier day by camel caravan from Siwa Oasis by the route over which caravans are still moving.

Next there is a scarcely more numerous generation, said to be at present 75 or 80 years old, and with the habit of the Egyptian to think in round numbers these generations may doubtless run together. There is still quite a gap in time before planters began to wake up to the fact that there might be money in this date from “Wahat el Sewah.” About 60 years ago one bold adventurer at Umm Khanan got hold of enough offshoots to plant about a third of a 4-feddan lot, still banking mostly on the old standby, Amhat; or he may have taken several years to do this, planting his own turnover in Saidy offshoots as they were ready. Still his neighbors were cautious until they became convinced that he was making real money; and the acreage that has made upper Giza Province famous for the best packing date in all Egypt consists of palms 15 to 30 or 40 years old, with young plantings rapidly coming on.

Wilkinson (*22, vol. 2, p. 358*), in his notes made in 1824, did not mention “Sewi” among Egyptian varieties. The few trees in bearing at that date doubtless did not attract his attention. Of the Saidy packed in Baharia for export to the valley, he says: “They are very sweet and rich, unlike any product in Egypt.”

If Delchevalerie (*5*), writing more than 50 years ago, had been an investigator, he must have found this date from Siwa that was beginning to have commercial importance; but they were easily confused with the Saidy from Siwa, then brought in quantity by caravans to Kerdaseh and Alexandria. It must be remembered that the name Saidy is still practically unknown in the Nile Valley.

COMPARISON OF CLIMATIC CONDITIONS IN EGYPT AND IN CALIFORNIA AND ARIZONA

As was stated in Department Bulletin No. 1125 (*13, p. 33*), the climatic records of upper Giza Province, the home of many thousands of the Saidy date, under the name of “Sewi,” show that it

matures sufficiently for curing into a very fine product under moderate temperatures and with morning dew points and fogs during an average of 20 days in each month of September and October. From these facts it was predicted that the Saidy might be successfully grown in localities in the Imperial Valley of California, where costly experience had shown that occasional periods of cool nights with morning dew points in August and September caused sufficient rotting of partly matured Deglet Noor fruits to make the culture of that variety too much of a hazard commercially.

Another locality from which the Deglet Noor has been still more effectually barred by cool nights and dew-point conditions is the Colorado Valley about Yuma, on both the California and the Arizona sides. With mean maximum temperatures about like those of Indio, Calif., the down draft of cool night air gives prevailing cool nights, with a mean daily range during the ripening season of 30° to 40° F. and frequent heavy dews.

Two trees growing in the Arizona Agricultural Experiment Station garden below Yuma are offshoots from Saidy trees imported from Siwa Oasis by the Office of Foreign Plant Introduction in 1905, and planted in the Cooperative Date Garden at Tempe. By some accident these Yuma trees had been mislabeled "Kaiby," another Siwa Oasis variety of the same importation, and had been reported as maturing very superior fruit for several years. It was not until November, 1923, that A. J. Shamblin, in charge of the United States Experiment Date Garden at Indio and head of the scale-inspection work of the Federal Horticultural Board, identified these trees as the true Saidy and obtained samples of fine fruit matured naturally on the trees.

This positive evidence of the ability of the Saidy date to mature high-quality fruit in the Colorado Valley under the adverse conditions of cool nights and dew-point humidity even more serious than those of Giza Province becomes of the highest importance to the future of the date industry in California and Arizona. It confirms the idea that the Saidy can be matured under dew-point conditions if day temperatures sufficiently high are included.

Considered in connection with the temperatures of Dakhla Oasis and Heluan, heretofore published (12; 13, pp. 28-29), and with various temperature records from points in California and Arizona, there is thus opened up a vast area as potential territory for the culture of the Saidy date.

In Table 2 are arranged the normal maximum and minimum temperatures for the seven growing months of the crop—April to October, inclusive—of six stations in the United States where the Saidy has been proved, in comparison with six others representative of territory for its possible extension in California and Arizona.

Dakhla Oasis, representing the Libian group of five oases, the home of the Saidy for more than a century, has the highest temperatures, a little above those of Mecca in the Coachella Valley (where the Saidy was fruited to perfection) and Calexico, representing the Imperial Valley, now assured as the greatest prospective date area in America. Heluan, Egypt, representing the great Nile

Valley area of the Saidy, has nights nearly 6 degrees F. warmer than Bard, Calif., but day temperatures more than 6 degrees F. lower, leaving the means of the seven months nearly the same. Now that it is known that the Saidy will fruit and mature at its best under the dew-point conditions of Yuma, the way is open for comparison with other river-valley points with nights cool from air drainage. Parker, with its 30,000 acres of Indian lands, has nearly the same temperatures, and this station is representative of the whole Palo Verde Valley. The Needles district, with limited irrigation possibilities, has warmer nights, but probably the immediate valley lands would prove about like those of Parker.

Buckeye and Sacaton, in the Gila Valley, have nearly uniform temperatures, a fraction warmer than Bard. Sacaton, Ariz., fairly represents a great area in the range of the Santa Cruz underflow, in the vicinity of Casa Grande and Maricopa, where lifting water for irrigation is rather expensive for cotton at normal prices, but could be made profitable for an intensive industry like date growing.

The former Arizona Agricultural Experiment Station, just outside of the city of Phoenix, shows mean maximum temperatures for the fruit-growing period 1 degree F. lower than Bard, but with the mean practically the same. Here one of the earliest imported "Sewi" trees in Arizona, possibly a Saidy seedling, matured its fruit successfully. The Mesa district is practically uniform with this station in temperature.

Both maximum and minimum records at the Cooperative Date Garden at Tempe are almost identical with those at Bard. Eight imported Saidy and "Siwah" trees have been growing there since 1904-1905. Their growth has been at the maximum for the variety, and heavy crops of fruit have been set. These have been late enough to pass the summer rains without damage, but with difficulty reached even the processing maturity, though of late some good fruit has been packed. The temperature records indicate that the fruit should mature to a stage to process perfectly.

HIGH WATER TABLE A FACTOR AT THE TEMPE DATE GARDEN

Since the establishment of the present irrigation system in 1907 in the district where the Cooperative Date Garden is situated, in the Salt River Valley, Ariz., the water level has been never lower than 4 feet, with the cooling effect of heavy surface evaporation. Although many earlier varieties have been able to mature under these conditions, the late-maturing Saidy has been retarded too far for commercial success. With the recent installation of a powerful drainage pump near this tract the lowering of the water table should enable this valuable date to reach full maturity this year. It reaches its highest perfection in heavy soils in Kharga, Dakhla, and the Nile Valley, and in the adobe soil of the garden at Tempe its yields have been much heavier than in the lean beach sand of the garden at Mecca, Calif. In any well-drained sandy clay soil of the districts represented in Table 2 the Saidy date ought to be a heavy producer.

TABLE 2.—*Mean temperatures of the growing-season months, April to October, for six proved stations for the Saidy date compared with six other localities representing prospective territory*

Stations and localities	Proved stations	Mean temperature (°F.)		
		Maxi-mum	Mini-mum	Average
Dakhla Oasis	1	99.68	67.0	83.34
Cooperative Date Garden, Mecca, Calif.	2	96.67	65.2	80.93
Calexico, Calif.		96.94	64.2	80.57
Helwan, Egypt	3	90.26	65.5	77.88
Bard, Calif. (near Yuma, Ariz.)	4	96.46	59.8	78.13
Parker, Ariz.		97.00	60.4	78.70
Needles, Calif.		94.40	65.7	80.05
Buckeye, Ariz.		96.70	60.4	78.56
Sacaton, Ariz.		96.04	61.3	78.67
Arizona Agricultural Experiment Station, Phoenix	5	95.43	60.3	77.86
Mesa, Ariz.		95.83	61.1	78.46
Cooperative Date Garden, Tempe, Ariz.	6	96.26	59.9	78.08

SATELLITE SEEDLINGS

The term "satellite" is proposed for the seedlings of a variety which so nearly resemble the parent variety that they are grown and marketed with it under the common name. The existence of such seedlings was first discovered in Egypt, but they probably occur in many other date-growing regions.

Where the color is close to the type, a seedling may differ rather widely from the parent in size and season of ripening without attracting the attention of growers not familiar with its accurate description. A notable case of this is the small-fruited type of Hayany described on page 20.

Some date varieties seem to have a much stronger tendency to come true from seed than others, and the Hayany has this trait the most highly developed of any variety known to the writer. The common Egyptian practice of selecting males from the seedlings of a variety would tend to enhance this trait, especially in a variety so long in cultivation.

It is a rather common occurrence for seedlings to spring up at the base of the tree, and care is required in order to distinguish them from true offshoots when the latter are dug up for transplanting. In this way a good many seedlings might slip in, in good faith, supposed to belong to the true variety. This may explain the Dongola opinion of the high value of trunk offshoots, precluding the possibility of being mistaken for a seedling.

The wide variation in the dates sold as "Ibrimi," dry dates brought down the river from Upper Egypt and the Sudan, would warrant the suspicion that the original Barakawi, or "Sukkoti," has produced seedlings, more or less true to type, till the name "Ibrimi" has become scarcely more than a trade name.

The large size and fine flavor of the dates of Nubia and Sukkot mentioned by Burckhardt, Wilkinson, Fischer, and other early writers suggest a great need for the study of individual trees for the selection of propagating stock.¹⁷

¹⁷ The identification by Bruce Drummond, for many years in charge of the Government date gardens at Indio and Mecca, Calif., of three apparently distinct strains of the Deglet Noor; the occurrence of the James Read Deglet Noor seedling at Thermal, a variety with characters determined by the writer to be within the range of technical variation of the Deglet Noor variety; as well as the existence of several "false Deglet Noor" trees, distinct from one another, in the Coachella Valley of California, all point to the possession in a moderate degree of this satellite tendency in the seedlings of this world-famous variety.

In the Amhat and Saidy varieties in Egypt, though they are as old as or older than the Hayany, the writer has so far been able to detect no tendency to satellites. If they exist it would require several seasons of very careful comparison during harvest time to segregate them. Though the opportunity for observation has been limited, the same seems to be true of the Bentamoda date as grown at Aswan and in Dongola.

CONSUMPTION OF DATES IN THE HARD-RIPE STAGE

The Arabic word "rutab" is applied to dates in a crisp or succulent stage. "Hard ripe" is the nearest English equivalent. They have laid down their sugar—which in the relatively cool climate of the Delta, especially along the coast, is present only in a low percentage—and retain comparatively little astringency from the soluble tannin.

According to Dowson (*6, pt. 1, pp. 29-32*) four stages of date maturity are recognized in Mesopotamia—"chimri, khalal, ratab, and tamar. * * * The khalal is of the same shape as the matured fruit, though the skin is never crinkled." Dowson gives a list of varieties of dates of the Shat el Arab, the colors of which in the khalal stage are yellow, red, and yellow spotted with red. He also presents a list of nine varieties which are "sweet, juicy, and pleasant to eat in the khalal stage and are esteemed a delicacy among the Arabs, though Europeans do not always care for them."

This author further states—

The ratab form of the date is reached when the apex becomes soft and, as its name denotes, moist. The skin usually becomes translucent and, as a rule, wrinkled, owing to the shrinking of the flesh. * * * Ratab dates are too squashy to transport far. There are few delicacies more delicious than Barhi ratab. * * * The tamar, or perfect date, is that stage in which the fruit is familiar in western markets.

That these stages are relative rather than absolute is shown by the fact that many delicious varieties at full maturity are so soft and fermentable that they are wholly incapable of being carried into the tamar stage and will spoil if not eaten at once. "Fine to-day, gone to-morrow" was the response of an Arab host to the writer's praise of most delicious rutab dates which he had set before his guest at a luncheon.

The immense crop of Hayany dates of Lower Egypt is harvested and shipped to the eager consumers in the crisp and juicy stage called "rutab" and "khalal" in Mesopotamia. The writer has adopted the Egyptian term "rutab" for all dates picked and shipped in the hard-ripe condition, although many of them may become soft and sticky before they are consumed. They are, however, preferred by most Egyptian consumers while they are still crisp and juicy.

It is difficult from an American standpoint to account for the great popularity of the rutab type of dates in Lower Egypt, as proved by the immense volume consumed, the product of nearly two million trees being absorbed in this stage of ripeness.

Apparently the appetite for them does not decrease with the advance of the season. After consuming the early-maturing Hayany dates of the Birket el Haggi and Giza districts, lasting from late August into October, the late-maturing coast region dates, shipped

more than 100 miles, are eagerly bought in the very districts around Cairo out of which the early crop was shipped. This is a demand which perhaps has its counterpart in the fondness of the natives for sugar cane, many acres of which are grown on the rich bottoms across the Nile from Cairo, not for the sugar factories but to be stripped and brought into Cairo on donkey carts and sold, a stalk at a time, to the poorer classes with a craving for something sweet in their diet.

That there is much to enjoy in dates in the crisp, hard-ripe rutab condition, if they are free from astringency, can not be denied, through many of them are ripened to a soft, mushy stage before being eaten. The taste for them is not confined to the lower classes, but they are enjoyed by Egyptian people of means and refinement, as well as by many Europeans. Here is a consumption of dates running into thousands of tons. The bulk of them are produced in regions where there is not sufficient heat to mature a packing date.

If a taste for this kind of date were developed and a demand for them created in the United States¹⁸ it would open up for date culture thousands of acres that are now just outside the border line of success for that undertaking. Reference is made to regions where the date palm as a tree grows well and sets abundant crops of fruit, but where the number of heat units for the growing season following the flowering is not sufficient to mature packing dates, but would mature the crop to the rutab stage.

Dates harvested in this stage of ripeness call for the lowest overhead cost in gathering, packing, and transportation of any form in which dates are handled (except the bone-dry bread dates of Upper Egypt, the Sudan, and other regions of intense heat and low humidity), though when softening has set in they are a very sticky product to handle in bulk.

It follows that long-distance shipment is precluded, and only markets that can be reached within a few hours from the production point are available,¹⁹ unless refrigerator cars are used.

VARIETIES SUITED TO THE RUTAB TRADE IN EGYPT

The Hayany variety, previously described in detail, is the principal date supplying the rutab market of Egypt and seems peculiarly adapted to this purpose. Its wide distribution throughout a region covering a considerable range in temperature and the extension of maturing time, apparently due to the numerous satellite seedlings included with the variety, keep its fruit before the public for about three or four months.

No other Egyptian variety has quite the same adaptation to this use in the juicy sweetness of its brittle flesh and the lack of serious astringency at the hard-ripe stage. Yet, although handling to best advantage in this condition, many consumers finally allow these dates to become semiripe and soft before eating.

¹⁸ It is worthy of note in this connection that in recent years the nonastringent Japanese persimmons of the Fuyu type that are eaten in crisp and juicy condition, like rutab dates, have become increasingly popular in the United States.

¹⁹ T. R. Robinson, in a conversation with the writer, stated that a number of seedling date palms in Key West, Fla., bear good crops of dates which are harvested in the khalal stage of maturity and are sold on the street in small paper bags. Though keenly relished by the boys of the street, they might be considered rather astringent by persons of more fastidious taste.

Beside the Hayany, the Amhat of Giza Province is becoming a strong second in the rutab trade. This variety, although a good packing date when allowed to ripen, is so popular in the fresh condition that its culture for that purpose is being considerably expanded in districts within easy reach of Cairo and its suburbs. The trees are found in but small numbers outside of Giza Province and scarcely at all across the Nile to the eastward.

Along the Mediterranean coast the Zagloul, Samany, and Bint Aischa, with a few Kobi, follow the Hayany variety in maturing and serve to prolong the rutab season well into the winter. The Samany is increasingly used for cooking in sugar syrup and stuffing with almond or pistache kernels, after which it is given a sugar coating.

It is an interesting feature of the development of the rutab-date trade that occasional lots of the "Sewi" are brought in for sale in this hard-ripe stage, but the variety is not likely to become a popular rutab date.

SHIPPING AND HANDLING RUTAB DATES

The hard-ripe Hayany dates are sometimes cut from the tree in the entire bunch, but generally they are stripped from the strands or shamrokh, those nearest to maturity being taken first. Light crates made from the date-leaf ribs holding about a bushel are common packages, but a greater favorite is a coiled basket sewed from rough braid made from the pinnæ, with a bushel or so of dates over which is a round cover of the same material quickly stitched on with a hand-twisted thread of finely shredded pinnæ. The date palms thus supply their own shipping packages.

Large shippers may take a rail-truck load on a fast train, but the local passenger trains carry a sort of accommodation express car with compartments opening on the side. In one of these compartments may be shipped an officer's saddle horse, a cow and her calf that a trader has picked up, crates of eggs packed in sugar-cane leaves, and in their season the various parcels of dates from the villages along the route. Such fruit is claimed at the end of the journey like baggage, and in a few minutes arrives at the bazaars or is taken directly by one of the innumerable small shopkeepers in the native quarters. Quick transit and quick distribution is the rule, though there is a little loss if a lot holds over a bit too long. The unfastidious fellah will take them at a bargain that will at least pay expenses.

Aside from railways, both standard and light, owned by the Government, there are scores of keen traders. One of these perhaps has a donkey or two with crates or baskets balanced over the saddle. Another, more prosperous, has a two-wheeled donkey cart with a platform on which he can stack a good many crates and baskets of dates. Either of these traders will range out of the city for several miles in search of the best bargains, and he knows just where to dispose of his purchases before there is danger of spoiling.

Under American conditions the hard-ripe dates probably would have to sustain a longer haul and would be packed in such wooden baskets as are now used for plums, apricots, or grapes, these again in crates. The crates, at least, could be machine-made from the leaf ribs. A system of quick disposal would have to be worked out, for soured dates mean a soured customer in this country.

For dates which pass quickly into a soft condition—and some of the richest and most delicious are of this character—canning in glass jars at the garden would seem to be the safest method of disposal.

CULTURAL OPERATIONS

OFFSHOOT PROPAGATION

Date-palm offshoots are a staple commodity in Egypt, with prices adjusted to what the market will bear, yet rather definitely graduated according to the desirability and abundance of the varieties and the size and quality of the offshoots in question.

Owing to their scarcity and the demand for planting in villa gardens in the Ramleh district along the Mediterranean shore, the offshoots of the Zagloul variety command the highest prices paid in Egypt, sometimes as much as £4 or £5 Egyptian being obtained for an exceptionally fine one. Samany offshoots bring somewhat less, but are also scarce and can be obtained only in small numbers.

Of the more abundant and strictly commercial varieties, Amri commands the highest prices and Amhat ranks next, though "Sewi," the valley name of the oasis Saidy, is but slightly cheaper.

There is a growing popularity of the Amhat date for consumption in the rutab or fresh state, and the ready cash which each picking brings into the bazaars of Giza or Cairo is an inducement to the grower. On the other hand, though the superior merits of the Saidy as a packing date are fully recognized, it is manifest that the grower must pay out money to his pickers, wait for his dates to be cured and packed, and then await the pleasure of the buyer to come and take them before he can realize on his year's output. For these reasons the Amhat is being planted more freely than the "Sewi" in Giza Province at the present, and the price of Amhat offshoots has stiffened accordingly.

Offshoots of the Hayany, the most abundant as well as the most prolific variety in Lower Egypt, can be purchased very cheaply in almost any numbers. As a rule the Egyptians have not been under the pressure to cut immature, unripe offshoots that prevailed during the early days of the date industry in California and Arizona. Offshoots of choice varieties that are veritable young trees in size often command fancy prices and justify the outlay by certainty of growth and quick development.

An interesting practice is followed in the sand-dune districts along the Mediterranean coast where brackish water, not too salty to support the date palm, is found over considerable areas at depths of 12 to 15 feet. A conical pit is dug down to the moist sand and a very large offshoot, sometimes nursery grown and often 6 or 7 feet high, is planted and covered for more than half its length in sand. When growth is well established the drifting sand is allowed to fill up around it as the tree grows, until the old level is reached. Along the Mediterranean coast of Egypt, quite out of reach of irrigation canals, there are many thousands of flourishing date trees which depend wholly on this underground water. Their owners often divide their time between caring for their trees and fishing in the shallow, brackish lakes which lie beside the sand-dune area.

In both Egypt and the Sudan there is a marked preference for offshoots from dry gardens, where the water supply has been scant and the growth slow, hard, and woody. Owners of such gardens are often able to demand for their offshoots double the prices that are realized for offshoots on lands near the river which have been over-watered and have a high ground-water table. Again, a small offshoot of hard, firm texture will be chosen in preference to one much larger of soft, sappy growth.

OFFSHOOT PRODUCTION ON OLD DATE PALMS

In gardens where the offshoots have not been cut while young and livestock, especially sheep and goats, have been allowed to graze among the trees, a curious condition often results. With the browsing off of the tops of the old offshoots new ones start from their bases, and these being more tender are again browsed off. The result is a perfect thicket of offshoots of all ages and sizes like a rudely trimmed hedge (pl. 5, *B*).

This habit has been especially noted in the Saidy (Sewi) variety in the rich bottom lands of Giza Province. It is a trait likely to prove of great value in hastening the propagation of this variety, of so much importance to southern California and Arizona, as well as in cases where offshoot production of other scarce varieties is specially desired. In America this principle can doubtless be applied in a more workmanlike way than the accidental one of Egypt, and a greatly increased production of Saidy offshoots may result.

Offshoots from the side of the trunk above the ground and without roots are little valued in Egypt. On the other hand, at a meeting of the omdas and other leading men of the villages, held upon the call of Governor Jackson at the governor's palace at Merowe, Dongola Province, September 20, 1913, one of the omdas declared: "If an offshoot springs from the trunk of a tree quite a distance from the ground it is very valuable and more sure to breed quite true to the variety than one coming from the ground at the foot of the tree." This idea may find an explanation in the fact that it is not uncommon for seedling trees to spring up at the base of an old tree, generally from its own seed, and such have occasionally been removed and sold as offshoots. These when fruited prove not true to the variety, though perhaps bearing a strong resemblance to it.

Observations in Egypt agree with experience in the United States in showing that the production of offshoots on the trunk of the date palm is first of all a varietal trait, but is also in a measure governed by the presence of ground water or by the character of irrigation. Of the important Egyptian varieties, the Hayany produces trunk offshoots the most freely and continues to produce them high up on the trunk, a trait which is much in evidence in this country. The Saidy has shown but a slight tendency in this direction and the Amhat practically none.²⁰ The season for cutting offshoots in Egypt is preferably February and March, with August for second choice.

²⁰ The Rhars variety, from the Algerian Sahara, has a strong tendency in America to produce offshoots high on the trunk.

The treatment of offshoots will necessarily vary much with local conditions. In Dongola Province, for example, the records show the lowest relative humidity of any date-growing country that has come under observation. In Department Bulletin No. 271 (12, p. 5) it is shown that the relative humidity for the year, on the basis of records covering 15 years, is only 22 per cent, with March, April, May, and June falling to 14, 14, 12, and 13 per cent, respectively, while the mean monthly temperatures ranged from 77° to 92° F., from March to June. Under such conditions the constant watering of newly set offshoots assumes the greatest importance.

In the date-growing Provinces of the Sudan—Berber, Dongola, and Halfa—August is preferred over all other months for transplanting offshoots. At "the rise of the Nile" is their way of expressing the choice of season. This involves not only the rise of the river, sometimes as much as 30 feet, culminating about the middle of September, but a lowering of the temperature several degrees during July and August and an increase in relative humidity; both are due to the advent of the tropical rains, only rare showers of which reach this far north. The rise of the river causes the saturation of the subsoil of all the lands adjacent, as well as the flooding of low lands and side channels. The water lift for the sakihs is but a slight one at this stage.

On a date plantation under English control near Korti, in Dongola Province, of 300 offshoots set in August, 1924, fully 90 per cent were making a good start as seen by the writer in the following December. The Mohammedan month comprising the latter part of February and early March is called "the growing month" by the natives of the Sudan, and they have certain wise sayings about the success of things planted at this season, which would about correspond to April and early May in southern California.

The low stage of the river, with the consequent difficult water lift and the approaching season of heat and dry air, are the points against this season for transplanting offshoots.

The omda of Barkel, a district comprising the sacred mountain of "Gebel Barkel" with its various pyramids, the owner of many date gardens, was very pronounced in favor of June as the most favorable month for moving date-palm offshoots. Though this is perhaps the most successful month for this work in the Coachella Valley of California, it seems to have few advocates in the Sudan.

Several of the chief men of the vicinity of Merowe, in conference with the governor of the Province, made the following recommendations:

(1) The offshoots, when possible, should be taken from "thirsty" trees; that is, trees with dry, hard tissues, because of the lack of a liberal supply of water.

(2) They should be set two-thirds of their length in the soil and one-third above, with a covering of matting or some such protecting material over the exposed portion.

(3) During the first season the offshoots should receive a little water morning and night during the first 40 days, water once a day for the next 40 days, and water every two or three days for the rest of the year.

In purchasing offshoots for shipment to the United States it has been pretty well demonstrated that July and August shipments do not bear transportation; but for immediate planting the time-tested

practice, both in Egypt and in the Sudan, of cutting in August can hardly be called in question.

A shipment of offshoots collected by the writer in Dongola Province about September 20 reached Cairo in fine condition, and when planted in the experiment station gardens at Giza, they at once began a healthy growth.²¹

The date gardeners in Egypt, and still more so in the Sudan, are handicapped by the lack of suitable tools for the removal of offshoots. Often with nothing but their worn-out cultivating hoes for digging and a small blunt chisel with which to sever the shoot from the trunk, they do not dig deeply enough to provide a ball of roots and are inclined to resort to wrenching and twisting to free the shoot from the mother trunk, often cracking and damaging it at the heart. The percentage of loss is considerable. A number of heavy offshoot chisels of the Drummond pattern were forged, under the writer's direction, for use in Dongola Province, and these are likely to work a revolution in offshoot removal in the Dongola reach of the Nile.

A practice which is reported to be in vogue in Sukkot is to wrap three or four offshoots tightly in a bundle with date fiber (leef) and old sacking and anchor them in the margin of a river or in a shallow pool until they form a mass of roots, then under further wrapping of leef they are transported by camel several days to the nearest market.

The valuable observations of Brown (*3, vol. 5, pp. 64-66*) on the propagation of the date palm by offshoots are here reproduced.

PROPAGATION BY MEANS OF OFFSHOOTS

When the offshoot is planted it very soon commences to make other offshoots, even if it has not done this before its removal from the parent tree. Some cultivators leave the offshoots until the mother plant has attained an age of from 15 to 20 years and then remove all the shoots at the same time. Others remove the most advanced shoots before that time and leave the smaller ones until later. * * * Under normal conditions a healthy tree produces 10 to 25 offshoots at its base. The entire group is known as a kôsha. * * *

The offshoots which arise at the surface of the ground commence rooting before they are severed from the parent stem, but there are often one or two situated higher up in the kôsha which show no signs of giving off roots. These are known as demmil or ta'oon and are usually thrown away as being unfit for planting, although the soil is sometimes heaped around them until roots appear. * * *

In Nubia the offshoots are usually allowed to grow on the mother tree until the young plants have stems 1 to 1½ meters long. They are then cut half through, bent to the ground, covered with earth, and watered by hand until the young tree has produced roots.

Date palms may be planted almost any season of the year. The time of the high Nile—August and September—is the most popular season in all parts of the country, but more especially in the south. The temperature is then comparatively low, the atmosphere moist, and water plentiful. Next to this the spring months of March and April are looked upon as being the most favorable season for planting. The vegetative growth of the trees commences toward the end of April or the beginning of May,²² and the offshoot

²¹ A planting of Deglet Noor offshoots cut and set near Indio, Calif., in August, 1923, when seen in 1924 promised a high percentage of success. About 90 per cent survived.

²² Mr. Brown has failed to note that the date palm has no really dormant period.

should be planted if possible before the natural season of growth begins. * * *

In the Province of Aswan the offshoots are most generally allowed to grow into fruit-bearing trees around the mother tree, and plantations are extended by means of offshoots which are brought down the river from Saccot. These offshoots are taken from the parent tree in Saccot in the month of February, when they are at once packed tightly together in bundles surrounded by sacking, matting, and straw, 18 to 25 suckers being packed in each bundle. When packed in this way they are placed near the edge of the river and kept wet until the month of May or June, after which they are taken by camel to Halfa for shipment to Aswan. They are watered during the voyage down the river, so that when they arrive at Aswan they are mostly well furnished with roots among the decomposing packing material.

A lot of offshoots of three choice Sukkot varieties, which were obtained for the writer in the spring of 1922 through the kindness of the governor of Halfa Province, were transported 150 miles by camel to Wadi Halfa, thence by boat and rail to Giza, where they arrived at the Government gardens in perfect condition. They stood the long shipment to the United States Experiment Date Garden at Indio, Calif., remarkably well. These offshoots were peculiar in that though small they were very hard and heavy, some of them sinking in water. They were evidently old and cut from what the natives call "thirsty" trees.²³ They were wrapped in convenient bundles covered with short wheat straw and chaff containing considerable grain, with layers of leef and sacking outside. Wetting the bundle had sprouted the grain, forming a moist layer which kept the offshoots in excellent condition. Of course, care would have to be taken that this sprouting condition did not run into fermentation and decay.

It is not an unusual thing to find a seedling date palm bearing the finest of fruit, but with no offshoots on it and past the age when offshoots are generally produced. To induce offshoot production in such a tree would be a very valuable achievement. Traditions are not wanting, in both Egypt and Algeria, of native gardeners so skillful that they can accomplish this much-desired result, but the actual accomplishment has never been satisfactorily demonstrated.

The writer did indeed get near enough to one of these wizards to be informed of the location of his town and was solemnly assured by a prominent Nile Valley attorney that in his town was a gardener to whom people resorted in just such an emergency. "He builds a tin box around the tree just below the leaves," the writer was assured, "fills it with earth, and waters it every day for a year. By that time he has offshoots growing." Unfortunately, my passage was already booked for America, and the English scientist who undertook to locate this gardener was retired from his post, so that he was unable to complete the investigation.

So this still remains one of the date-cultural problems yet to be worked out. Rather an expensive way of obtaining offshoots, perhaps, if computed by American wage standards; but there is at least one variety, represented by a single tree growing in sight of Indio, Calif., from which a crop of offshoots would be worth far more than a year's labor.

²³ They are a most valuable type for long-distance shipment and may have had an origin similar to those shown in Plate 5, B.

PLANTING DISTANCES

The Egyptian date growers generally plant their palms much more closely than is considered good practice in the United States. Whereas setting the trees 30 feet apart, giving 48 or 49 trees in square planting to the acre and allowing 100 square yards to the tree, has here come to be the most approved spacing, the Egyptian feddan of 5.024 square yards will often carry 100 or 120 palms, which allows only 42 to 50 square yards to the tree.

There is a tendency on the part of the more thoughtful Egyptian growers, however, to regard the old close spacing as less profitable than more open planting, and in some of the younger plantations, arranged in straight rows instead of the old "hit-or-miss" planting, 72 to 80 trees to the feddan will be found on good heavy ground and as low as 60 trees on thin sandy soil.

In mature plantations of Hayany near Ramleh 7 yards apart, or about 113 trees to the feddan, is a common distance, which by no means proves that this is the most profitable distance for planting. The Hayany, being a smaller, more quickly maturing palm, would doubtless admit of closer planting than the Amhat or the Saidy.

A factor that must be taken into account is the light intensity as influenced both by relative humidity and by latitude. Photosynthesis in the date palm is profoundly influenced by the intensity of the sunlight, and the difference in light intensity at Alexandria (lat. 32° and average humidity 68 per cent) and Dongola Province (lat. 18° and relative humidity 22 per cent) will have a marked effect on the starch-making capacity of palms in the two localities. Date palms in the coastal region should have the fullest exposure to sunlight in order to do their work most perfectly.

The system of culture known as "mother and daughters," common in Upper Egypt and the Sudan, gives a much greater number of crowns to the feddan than should be permitted in the reduced light intensity of Ramleh. Water and fertility would then become the limiting factors. See Department Bulletin No. 271 (*12, p. 21, pl. 4, fig. 2*).

UNDERCULTURES IN DATE-PALM PLANTINGS

Underculture crops comprise part-season or catch crops and permanent plantings, as of trees, shrubs, and vines. Generally speaking, date trees are found (1) in gardens which are taxed as a whole, without enumerating the trees, where the palms form a part of a miscellaneous collection of fruiting and ornamental trees, and (2) in field or acreage culture where the date trees constitute the entire or the chief planting.

Where the date trees occupy the land, some attempt is usually made at growing part-season crops, such as wheat, various varieties of beans, and (best of all) berseem. Wheat will do the best where the stand of palms is a broken one, but is at best a makeshift crop and can not afford much profit. Beans and lupines are sown broadcast and scratched in rather lightly. They make a quick return while adding something to the soil through their root nodules. Berseem, sown in autumn, is cut three or four times as a green forage crop, usually being fed to buffalo dairy cows which are tethered around the borders of the date grove. This crop adds considerable

nitrogen and humus to the soil, which in many cases is beginning to suffer from lack of the annual deposit of Nile silt which it formerly received under basin irrigation. The grazing of sheep and goats and even cattle and donkeys under the date trees insures that nothing that any animal can eat will go to waste.

DATE PALMS AND OTHER FRUIT TREES

Occasionally a tract of several feddans will be given to a mixed culture of date palms and limes or guavas. In such tracts the palms are usually scattering, not more than 30 or 40 to the feddan. In such orchards as were observed the date palms were not at their best and it is to be doubted whether other trees were. Only detailed records of the yields of both crops over a period of years could determine whether such a system of culture is profitable. Brown (*3, vol. 6, p. 29*) attributes the low yield of certain Hayany trees at Giza to the fact that "they are intermingled with other trees, such as guavas."

Around Alexandria and Ramleh considerable attention has been given in the last few years to the growing of a small variety of banana, and the profits derived from some gardens tempted the owners of several Hayany gardens to underplant their trees with bananas. It was only where the date palms were very open and scattering, giving the bananas full sunlight, that there was any degree of success in this.

In estate gardens, sometimes of several feddans, where dates are grown as a part of a general production of fruit and vegetables, the date palms are not usually more than 30 or 40 to a feddan, often not more than 20. They are apt to be distributed around the borders or along walks or drives. From the outside they give the impression of being closely planted, when really they have plenty of room and thrive accordingly.

Undercultures of legumes, vegetables, or shallow-rooted fruit shrubs may be made to advantage among palms occupying 85 to 100 square yards of space if a full supply of water and fertilizer is assured; but the writer is convinced that strong-rooting fruit trees of the citrus family, guavas, and figs can not be made commercially profitable without greatly reducing the number of palms.

CULTIVATING AND IRRIGATING

The cultivation of date gardens in Egypt is desultory, and beyond a shiftless scratching of the soil for sowing wheat or berseem little is done except in carefully kept domestic gardens. Where there is a perennial supply of water from canals, irrigation is usually by flooding. Many gardens or small plats lying just above gravity water are watered with an ingenious arrangement of the Archimedean screw which looks like a staved cylinder on the outside, but has spiral septa skillfully built within. This is set up at an angle of about 30° , and the lower end is plunged in a canal or pool of water. With fellah power applied to an iron crank quite a stream of water may be lifted 2 or 3 feet. Then the apparatus can be taken across a donkey's back in front of his rider and moved to another field or returned to the neighbor who lent it.

The shadoof, invented long before the time of the Pharoahs, has been modified in 4,000 years by substituting a galvanized-iron bucket for one of rawhide and is still the means of getting water to thousands of acres of crops out of the reach of gravity flow. These sweeps are often placed in pairs, side by side, and as the range of lift is only 5 or 6 feet, sometimes two or three relays are needed to raise the water from the canal or river to the level of the fields.

The sakiéh, with its three great geared wooden wheels propelled by a camel or blindfolded cow, lifts the water by an endless chain of buckets attached to a pair of cables made from the fruit-bearing stalks or the pinnæ of the date palm.

Many date orchards have a flow of canal water in the winter, but must depend on wells to carry the crop through the summer.

Some of the larger estates have installed engines and pumps of various types, but unless the property is large enough to pay the salary of a skilled engineer the sakiéhs, which the native gardeners can easily keep in repair, take the lead in real efficiency and economy.

MAINTAINING SOIL FERTILITY

Egypt depended for untold centuries upon the annual deposit of silt from "Mother Nile" to maintain the fertility of her lands, and the arrival of each year's flood was a day of festivity and rejoicing. Since the building of the great dam at Aswan the heaviest silt is sent down to the sea and only the clearer water stored, so that the land lacks the annual fertilizing.

The problem of maintaining soil fertility under the production of two and three crops a year is rapidly becoming a serious one. It is the more so as, with the great scarcity and high price of fuel, the manure from the stock that is kept is worked up into little cakes for the cooking fires, so that the land gets little return from the straw and forage produced. Even the wheat crop is sometimes pulled instead of being reaped, and the soil is deprived of even the stubble.

The growing of berseem among date palms in winter as a forage and soiling crop is the most hopeful practice that was observed. Even then the most that the soil receives is the nitrogen from the root nodules. With four or five cuttings of forage removed there is little return for the mineral salts extracted from the soil.

The need of fertilizers is recognized in the fact that the refuse from ruined towns and villages is screened and carried to the gardens in deep conical baskets balanced over camel saddles. An analysis of this material under the direction of the Ministry of Agriculture showed that its application was of rather doubtful utility.

In Kharga and Dahkla Oases considerable beds of low-grade phosphate rock have been reported in the geological surveys. Date gardens getting the wash from adjacent bluffs containing these beds have maintained a fine appearance, as though well fertilized. Whether the percentage of phosphate is high enough to warrant commercial handling and export to the valley seems to need further investigation.

PRUNING

Pruning practices differ in a very marked way in the different sections of Egypt and the Sudan. In Lower Egypt, including

Giza Province, the trees are pruned very high, leaving but a tuft of leaves against the sky line, below which the bunches of fruit on the bent-over "sobata," or fruitstalks, show very conspicuously (pl. 6) before and after pruning. Not more than 40 or 50 leaves are left after this operation. It seems probable that two factors govern in this close pruning—one climatic, the other commercial.

With the mean summer temperatures ranging 6 to 8 degrees F. lower than in Upper Egypt and the percentage of humidity two or two and a half times as high, the efficiency of the sun's rays in developing sugar and ripening the fruit is greatly reduced. Full exposure of the fruit bunches to the sunlight and exposure of the trunk to the heat appear to be the important considerations.

Aside from the regular leaf pruning, in which the rib (*gerid*) of the leaf is lopped off to within 12 or 15 inches of the base, there is a somewhat irregular second pruning in which the wide leaf base is cut away and the exposed layers of the leaf fiber pulled or cut out. (Pl. 7, A.) This leaves the naked trunk free of that double zone of leaf bases and fiber (*leef*) which is so important an insulator to the palm tree in the more intensely heated regions. Even with this aid to heat penetration, the fruit of the coastal region reaches only the hard-ripe (*rutab*) stage by November or December, and often hangs on the trees until well into the winter.

The utilization of the midribs (*gerid*) in crate making—a practice much more prevalent in Lower Egypt than it is farther up the river—offers a constant temptation to close pruning. With the attractive price of £2 or £3 per thousand (\$10 to \$15, United States money), the gardener who holds 50 or 100 trees under lease is inclined to prune as closely as he dares in order to increase his income.

An interesting phase of pruning in the coastal regions of Egypt is brought about by the prevailing high winds blowing inland from the Mediterranean, which cause much damage to the tender growing fruit by beating the heavy bunches against the spines and leaf bases if they are not carefully protected. This protection is provided by leaving a number of the midribs sufficiently long when pruning to allow the fruitstalks to be lashed to them with stout cords, which the Egyptian gardener deftly twists between the palms of his hands from pinnæ within his reach. This practice of lashing the fruit bunches to prevent threshing in the high spring winds is one which might be very profitably followed in many exposed situations of the Coachella Valley.

In Upper Egypt and the Sudan the pruning of the date palms is much less severe, a larger crown being retained and the close pruning of the leaf bases and the removal of the insulating fiber (*leef*) layers not being practiced. This is a great advantage to the trees in maintaining their resistance to the fierce rays of the tropical sun, but whether this is recognized by the native cultivators or whether the lack of a ready market for the pruned leafstalks (*gerid*) and the store of fiber has failed to stimulate the practice of close pruning is a debatable question.

A practice which may well be included under the topic of pruning is the cutting of offshoots which spring from the trunk of the palm at some distance from the ground. Such shoots are not considered by the natives of Lower Egypt to have any value for propagation purposes, but they believe that their growth diminishes the fruit

production of the tree, so they keep them smoothly pruned off even with the leaf bases. This offshoot production on the trunks is in part a varietal character, being continuous in some varieties for many years, but their growth is greatly stimulated by conditions of excessive ground water and high atmospheric humidity. Notable

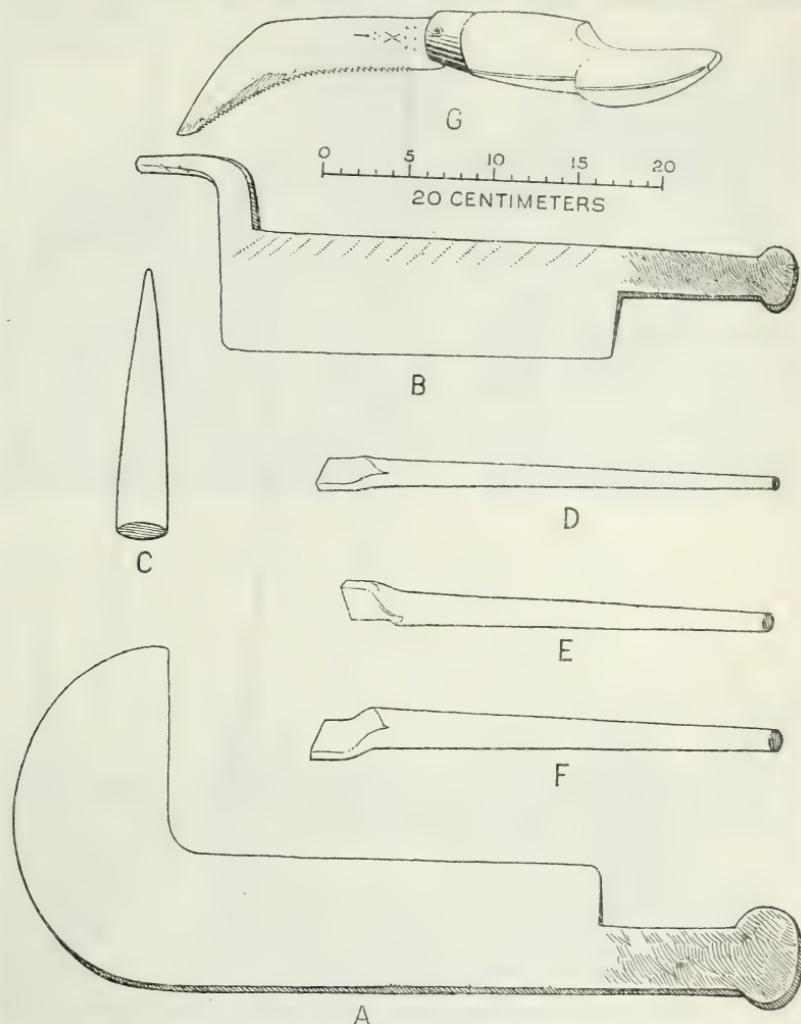


FIG. 6.—Tools used by native workers in Egypt in the manufacture of crates and other articles from date-leaf midribs (gerid). The 20-centimeter scale shows the relative sizes of the tools

examples of such shoot production can be seen on the Hayany trunks near the villages of El Marg and Birket el Haggi, a few miles northeast of Cairo.

As with most date-palm operations, pruning after a few years becomes one of the jobs for the tree climber, but the tools used vary with the neighborhood. Around El Marg much use is made of a thin-backed saw with a curved blade which shuts up into a groove in a hardwood handle (fig. 6, *G*). Others have a slightly hooked steel

blade about 9 inches long, set rigidly at an angle of approximately 105° into a round wooden handle some 18 inches long. One of the most efficient pruning tools seen in Egypt was a thin-bladed hatchet with a round cutting edge (fig. 7), which is used in all the upper Giza region. A smith in Mit Riheina, a village on the site of ancient Memphis, makes most of the tools in the entire district.

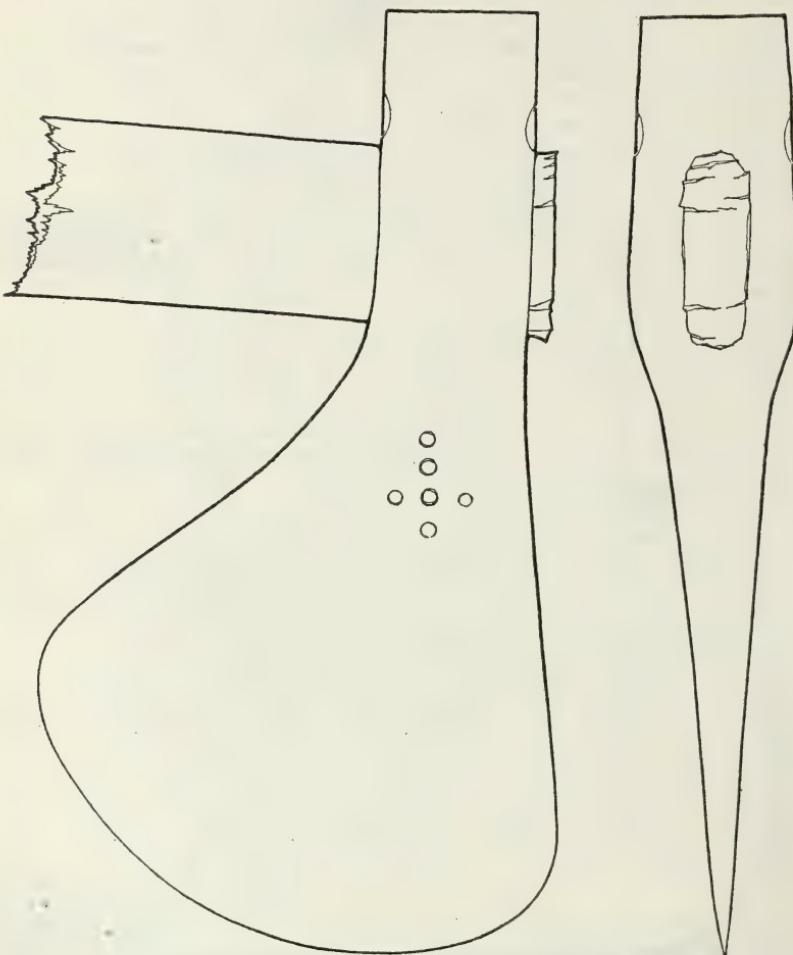


FIG. 7.—Hatchet used by workmen in upper Giza Province, Egypt, for pruning dates.
(One-half natural size)

They may be of solid steel or with only a steel bit laid into iron. The sample purchased weighs 2 pounds 15 ounces with the handle, but this is too heavy. The favorite hatchets used by the tree pruners of the district would not weigh more than 2 pounds. The thinness of the blade is carried back nearly to the eye, while the hammerlike head gives the balance. A light blow on each side of the rib sends it down, leaving a fishtail notch in the end of the petiole.

A later pruning takes off the broad base of the leafstalk, which is used for fuel or occasionally for the trees of the camel packsaddle,

**DATE-PALM CULTURAL PROCESSES**

- A.—A Saidy tree near El Hawamdiya, freshly pruned. The two long petioles above show the first pruning, which removes only the midrib. The broad bases below show where the second pruning has removed a 12-inch stick of fuel and permits the pulling out of several pounds of leaf fiber
- B.—Railway platform at El Hawamdiya. Gardeners are here seen sorting over unopened male date-palm spathes shipped from Fayum, a few of which have burst open during transit and are lying on the pavement in the foreground



HARVESTING DATES IN EGYPT

A.—Egyptian tree climber preparing to ascend a Hayany palm near El Marg. This climber has discarded his slippers and is trusting his life to his climber's girdle and rope wrapped with rawhide. On his back is the basket into which he is to place the hard-ripe fruit, which is to be lowered to the ground by the rope which trails behind him.

B.—An Egyptian tree climber at Giza. The Amhat date palm which this man is climbing is 75 feet high. Notice the breadth of the climber's girdle and the size indicating the strength of the rope around the tree, all hand twisted from fibers of the fruitstalk of the date palm. The broad gathering basket shown is adapted to saving the softening Amhat fruit.

and the cut releases the numerous layers of the brown fibrous basal sheaths (Arabic, "leef"). This varies considerably in fineness and strength with the different varieties of dates and also with the soil and locality. An average of 26 piasters per kantar, or about \$1.20 per hundredweight, was the best price at which this material could be bought on contract for several tons used in packing the date offshoots shipped to California.

POLLINATION

POLLINATION PRACTICES IN EGYPT

In general, pollination practices in Egypt correspond closely with those of other date-producing regions. As soon as the fruiting spathe is ruptured by the expanding flowers, or within a few days of this event, the gardener climbs the tree, taking with him a supply of strands cut from the male inflorescence, carried in a little flat-braided basket suspended by a cord in front of him. If the spathe is only ruptured the inflorescence is pulled out and a sprig of the male flowers tied in with a thread pulled from a leaflet within reach.

A most unique and primitive method of pollination as practiced in Siwa Oasis, in the northern Libian Desert, is described by Belgrave (1, p. 157). He states:

A branch (flower head with stalk) is cut from the male date tree, which bears no fruit, sharpened, and thrust into the trunk of the female tree. Unless this is done to every tree, the fruit becomes small and worthless.

In the development of artificial pollination to replace the wind pollination of natural seedling groves, nothing can be conceived of more primitive than this.

In considerable plantations a regular round is followed, so that any given tree is reached only once in about three or four days. On the last round a fragment of leef the size of a pocket handkerchief is tied to a lower midrib in a conspicuous place to indicate that work on that tree is finished.

An attempt to learn how long the flowers remained in a receptive condition elicited much difference of opinion. The limit of vitality was placed at from 5 to 8 days, but the often-expressed opinion was that pollination was best at the day of opening and good for 3 or 4 days after. About 20 trees is considered a day's work in pollinating trees 50 to 60 feet high, though sometimes not more than 15 trees are done.

Pollination practices in the Sudan differ considerably from those observed in any other country. The use of the climbing girdle has apparently never been introduced. In spite of the crude methods of pruning, in which the persistent leaf bases are left long and as sharp as bayonets, young boys climb the trees, without ropes or girdles, with the agility of monkeys.

The native male spathes, some having already burst, others unopened, are brought together in a sheltered spot and the flower heads removed from the "boat," as the Dongola natives call the spathe or casing, and the branchlets or "fingers" cut off with a sharp knife. The longer branchlets are cut in two. These pieces are made up in little bundles of three or four, along with a piece cut from the wall of the spathe, apparently to give stiffness to the bundle, and wrapped

with shreds of fiber stripped also from the spathe. The pollinators themselves usually do this work of making up the little bundles, but Edward Jackson, on his 120-feddan plantation at Mansureoti, realizing that the girls and women with their nimble fingers are more deft than the men, turned this work over to them, with very satisfactory results.

The pollinator fills a little basket, suspended from his neck, with the bundles of flowers and starts on his morning rounds in search of newly opened female flower heads. He carries a sickle-edged knife with a curved blade to help him clear his way in the palm top, but his skill in avoiding the leaf spines is marvelous. While he is up in the tree top, if he finds a spathe which is full and plump, nearly ready to burst, he pulls it open and pollinates it with the others by merely wedging one of the bundles between the strands of the flower head. With the dry air and scorching winds to which this country is subject, this method of bunching the flower stems probably has a real advantage.

SELECTION OF MALE TREES

Some gardeners were found who contended that a good male date tree was equally good for the pollination of all varieties of dates, but the general opinion was that for each variety there were males specially adapted. Most gardens contained favorite male trees which the owner believed to be especially fitted for the pollination of his most abundant variety, though surplus pollen might be used for others. In a garden above Giza a male that was recommended as the correct "dakar" for use on the Sewi (Saidy) variety was, on close questioning, alleged to be a Sewi mantour, or seedling.

It is a very significant fact that with a purchase of 50 offshoots each of Gondeila, Bentamoda, and Barakawi varieties, shipped from the Sukkot region below the Third Cataract of the Nile, each lot came with 5 additional offshoots labeled "Gondeila Dakar," "Bentamoda Dakar," and "Barakawi Dakar," respectively. The growers in Dongola Province often make sharp discrimination in mating the different male and female palms, but their chief reasons are difficult to understand. For example, they asserted that the pollen of a certain male tree was "too hot" for use on palms of a certain female variety, causing them to drop their young fruit.

With vigor of growth and flower production assumed, together with potency of the pollen, there would still remain three other factors necessary to render a given male specially adapted to the pollination of any particular fruiting variety, namely: (1) Seasonableness, flowering at a time to meet the requirements of the fruiting variety; (2) compatibility, that indefinable adaptation in the relations between the male and female individuals in the plant and animal world by which fecundity is assured; and (3) least understood of all, that degree of congruity which secures the best quality in the fruit resulting from a given pollination. Probably the fellah date gardener has never definitely formulated the second and third of these requirements in his mind, although he may unconsciously recognize them.

The unwritten Egyptian lore regarding the date palm and its practical culture is the accumulation of no less than 4,000 years.

Pictures of pleasure gardens with unmistakable figures of date palms surrounding a small pool or lake in the center are found in some of the tombs of the nobles near Queen Hatsu's temple at Thebes, of the period of about 1500 or 1450 B. C. In one spirited picture the noble lord and his lady are seated in a boat with two tow ropes and being drawn about the lake by slaves, while others are picking very red dates for them from a tree growing on the bank.

Archæologists state that in recent excavations at Tel el Amarna, in Upper Egypt, pertaining to a period about 1430 B. C., large quantities of date seeds were found in the ruins of the dwellings, probably from dates stored for food, of which the weevils had left nothing but the seeds. With the tenacity with which the modern Egyptian clings to ancient agricultural practices, such as the wooden plow and the "shadoof" for lifting irrigation water, it can hardly be doubted that the idea that certain male date palms give superior results when used in the pollination of their favorite fruiting varieties is of very ancient origin.

Brown (*3*, vol. 5, p. 77) has the following to say about the quantity of pollen required:

A male inflorescence of average size is reckoned as being sufficient to pollinate all the fruit-bearing bunches of five palms which are ready for fertilization on one day. Some trees, of course, require more pollen than others. The early bunches of any variety are larger than those which come later in the season and therefore require more pollen. The quantity of male flowers required is not, however, regulated entirely by the size of the fruiting bunch.

Some varieties require much more pollen than others, irrespective of the above consideration. For example, it is necessary to use much more on the Siwi than on the Amhat, although the bunches of the latter are equal in size to those of the former and contain as many fruits.

Brown also states that the date growers of Upper Egypt use a greater quantity of male flowers than do those of Lower Egypt, consequently requiring a higher proportion of male to female trees. About 1 male to 50 female trees, he states, is the usual proportion maintained in Lower Egypt.

As to the size of the bunches making any difference in the quantity of male flowers required, when one considers the almost infinite number of pollen grains contained in a single "finger" of male flowers a difference of a few dozen or so of a hundred fruiting flowers in a bunch could make no difference in the resulting fecundation, and late bunches on a tree which have been subject only to "catch pollination" often set as many dates as the earlier ones pollinated with the greatest care.

As to the relative quantities of pollen required by different varieties, this in the end must depend on the relative vitality of the pollen used and on their compatibility with the different fruiting varieties. At the United States Experiment Date Garden, Indio, Calif., it was repeatedly demonstrated by culture tests made by Stout (*19*) that pollen from different trees, though produced in abundance, might vary in viability from zero to nearly 100 per cent. Again it has been demonstrated by the writer during the season of 1924 that with pollen of high viability, used on the same day on different varieties, the percentage of fecundation might vary from 10 or 12 to as high as 85 or 90 per cent—purely a matter of compatibility between male and female varieties.

RAIN INJURY AND VARIATION IN FLOWERING PERIOD

The Delta region of Egypt and the Nile Valley as far as upper Giza Province are subject to occasional cold, drizzly spring rains, and nothing is more dreaded by the date grower than their occurrence at the time when his date trees are in full bloom.

There is considerable difference in the flowering period of different varieties, so that in a mixed garden the pollination of one may fail, and another variety may escape the unfavorable weather and set a full crop. Around El Marg the Amri is one of the earliest varieties to bloom, but not far ahead of the Hayany. In the upper Giza country the Amhat is the earliest variety to flower, the Hayany next, and the Saidy several days later. The young trees of a variety are said to be usually some days later in flowering than the old ones.

Trees that did not fruit the previous year are expected to flower several days earlier than those of the same variety that bore a good crop. As one gardener put it, "When trees have a good rest, they are ready to begin work earlier the next year."

The progress of the seasons in different latitudes is a well-marked feature in date pollination. In the region of Merowe and Korti, in Dongola Province, date pollination was in full swing by February 15, 1925, and more than half completed by March 1. At Wadi Halfa, from March 4 to 6, pollination was decidedly more backward than at Merawi. At Cairo, from April 3 to 5, pollination was about as far advanced as it was at Merowe on March 1 and 2; that is, 15 degrees of latitude, or about 1,000 miles, made an approximate difference of one month in date-palm flowering.

In the Giza district there is a considerable scarcity of male trees, and male flower heads are a staple commodity commanding fair prices, according to the standards for other articles.

CUTTING MALE SPATHES BEFORE OPENING

Fayum, with its prevalent growth of balady, or seedling, trees, is a reliable source of supply of pollen, and small rail-truck loads of the plump but unopened spathes may be seen unloading at the sidings of Bedrashen and El Hawamdiya during the pollinating season.

A very important detail in pollination practice is here brought to light. The flowers are not allowed to remain on the trees until they burst the spathe and are fully open, as is the American practice, but the spathes are cut when they are nearly matured, before the bursting point has been reached. The proper degree of maturity can be judged by the degree of plumpness the spathes have attained and by the appearance of the "erion," or wool, on the surface. When the spathes are cut at the right stage, the pollen is sufficiently matured to be fully efficient; yet, excepting a few which may split open on the way, there is no waste from discharge, and a lot of spathes can be transported considerable distances, as, for example, from Fayum to Bedrashen or El Hawamdiya, about as readily as the same weight of onions or cabbage. When the spathes have

been collected at the gardens and pollen is required, one is split with a sharp knife and the fingers of the flower head cut off for convenient use.

Male flowers, which under the usual American methods remain on the tree till the spathes burst and the flowers open, begin to discharge their pollen at once, and much of it is wasted either by the wind or by being carried away by bees. The mere disturbance of cutting the flower head from the spathe and bringing it to the storeroom wastes another portion of the pollen; and the chances are that the sprigs or fingers of the flowers, by the time they are placed in the fruiting head in the operation of pollination, will be depleted of a good share of their pollen.

This Egyptian method of cutting the unopened spathes undoubtedly possesses very great advantages, especially in transporting the flowers from the trees to the point where they are to be used. Some experience will doubtless be needed to enable the cultivator to select the opportune time for cutting the spathes, obtaining full development without the risk of bursting. With the utmost experience a small percentage may open after they are cut, but such do not discharge much pollen until the fingers are exposed to the air.

To judge from the following extract from Dowson (*C, pt. 1, p. 27*) a similar practice seems to prevail in Mesopotamia.

It is the custom for the whole unopened male spathe to be cut from the palm immediately before ripening and the inflorescence extracted through an artificial incision and left a day or two in a small basket to mature. In this way no pollen is wasted.

The photograph used for Plate 7, *B*, was made at El Hawam-diya in March, 1914, where a railway truck load of male spathes had been received from the Oasis of Fayum and sorted and parceled out among several garden owners of the neighborhood. It will be noticed that in the foreground are a number of split spathes which have been sorted out for immediate use. The price was 2 to 4 piasters, amounting in United States money to 10 to 20 cents a spathe, a price which, allowing from 10 to 20 spathes to the tree, would give a return of only \$1 to \$4 a tree—not more than half the return from a fruiting tree of the choicer varieties, as Amhat, Hayany, or Saidy.

Under American conditions a fruiting date garden can be counted upon to give a gross return of not less than \$500 an acre, one year with another. Male trees might be planted considerably closer than females, say 75 trees to the acre, though they usually occupy odd spaces rather than acreage. Allowing 75 trees to the acre and an average of 12 spathes to the tree, the yield would be 900 spathes, which should command a minimum of \$500, or 55 cents each, with extra-large fine ones of proved virility bringing \$1 each and well worth it.

Only when the value of male date flowers is thus placed on a commercial basis will the date grower realize that he should provide a sufficient number of male trees to take care of his maximum crop with a margin of safety. As fast as he can test them he should see to it that these males have that degree of compatibility which will give the best results with the varieties he is cultivating.

USE OF OLD POLLEN

The opinion is prevalent in Egypt that date pollen may be carried over and used successfully the following year. A Ramleh gardener stated that pollen flowers to be kept over should be dried in the sun, put away in a tight box or closet, and "must not afterwards see the light of the sun or moon." Treated in this way, he said, "pollen would keep good for a year."

Testimony as to the value of old pollen in America is so contradictory that the field is still open to further experimentation. Stout (19), in testing the viability of many samples of date pollen on agar-sugar culture media, has so far failed to record a single instance of germination of pollen a year old, yet some careful growers in the Coachella Valley insist that they have obtained good commercial setting of fruit with the use of stored pollen of the previous year.

HARVESTING AND PACKING

Date harvesting in Lower Egypt differs from that in Upper Egypt or Algeria because the larger part of the dates produced are of varieties consumed in the rutab state.

HARVESTING THE HAYANY DATE

The Hayany is the chief date of Lower Egypt, from the coastal dunes to the margin of the Delta bordering the desert near Cairo.

The earliest fruit reaches the rutab stage in the vicinity of the village of Birket el Haggi, closely bordering the desert, 10 miles northeast of Cairo, in the latter part of August. Still hard and brittle and retaining fully its beautiful pure carmine color, it is juicy and pleasantly sweet as a joint of sugar cane. In this condition the dates are stripped from the strands and shipped in bulk in small crates or in braided pinna baskets to Cairo, Alexandria, and all parts of the densely populated Delta.

The output could be estimated in thousands of tons. Some of the larger plantations near El Marg are equipped with light railways. Over these the crop is brought to the steam road in little cars drawn by donkeys or by diminutive plantation engines.

Even more important than prompt pollination is the getting of this rutab fruit to the consumer before it begins to brown and soften, for a worse gaumed-up mess is hard to imagine than a bushel mass of these dates after softening has set in. The tree climber, with his trusty climbing girdle and rope—every cord hand twisted and tested, for on it his life depends—is veritably the man of the hour (pl. 8, A).

As the early Hayany dates from the El Marg district go off the market they are followed by those of later localities, till finally the coast-dune dates of the Ramleh and Rosetta districts reach the bazaars about November, thus keeping this favorite date before the consumer for fully 100 days.

Kobi, Bint Aischa, Zagloul, and Samany are other rutab dates of the coast region which are produced in limited quantities, the two latter sometimes holding out into March.

HARVESTING THE AMHAT DATE

In the upper Giza district the chief date grown for fresh consumption is the Amhat, though some gardens of the Hayany have been planted in order to catch the profitable early rutab market.

The Amhat is the tallest growing date palm in Egypt, and many gardens may be seen which are reputed to be more than 100 years old, with the trees averaging 75 feet in height. A tree near El Hawamdiya in vigorous bearing was found to be 92½ feet to the top of the bud. (See fig. 8, *A-X.*) It may be surmised that harvesting the fruit from such a tree presents real difficulties. (Pl. 8, *B.*)

The Amhat is a short, plump, yellow date, ripening to amber and finally dark brown. (See description, p. 10.) Some of the fruit is allowed to reach the first softening stage on the tree, when it is readily shaken from the strands. It is then very sweet and rather sticky and is greatly relished by all classes of Egyptians. It is handled with much greater care than the Hayany, though the sticky, fly-covered piles of this fruit seen in the native shops could hardly be sold to a European or American consumer.

A special gathering basket for handling the Amhat fruit (pl. 8, *B*) is made by sewing broad pinna braid spirally into a circular disk about 4 feet in diameter. This is bound to a stiff rim of oak barrel-hoop stuff, the only imported material in the equipment. Four brail ropes united are attached to a long hoisting rope about half an inch in diameter, all hand twisted from the leef (sheath fiber) of the date tree. A stout wooden hook is also attached to the brail ropes. The climber attaches the hoisting rope to his belt. With the aid of his climbing girdle he ascends the tree, perhaps 70 or 75 feet high, as quickly as a squirrel. Throwing the hoisting rope over a strong leaf base he hauls up the gathering basket and hooks it under a bunch containing a lot of ripening fruit. Shaking out all that are readily loosened and stripping the more matured fruit that remains, he moves to another bunch, all the time supported by his feet braced against the stubs of the leaf bases and the girdle rope encircling the trunk, with the broad part like a saddle girth across his back under his arms. When as much fruit has been thus gathered on the slightly cupped bottom of the basket as is safe from bruising, it is lowered to the helper and returned for refilling. Four or five such refillings may be needed to complete the tree.

Because of the quick sales of the fresh dates, with the money in the grower's hand without cost for drying yards, baskets, or packing, the Amhat date is becoming increasingly popular in the Giza country adjacent to Cairo and is now planted more generally than the superior Saidy ("Sewi"), upon which the initial outlay is greater and the returns from which leave no greater net profit. The problem is purely one of an available market.

In the sparsely populated oases, with little consumption of fresh dates beyond the waste from the commercial gardens, a variety like the Amhat would be set aside for the readily packed, long-keeping, easily transported Saidy, which has a reputation of more than 100 years to sell it the moment it arrives in the valley towns.

HARVESTING THE AMRI DATE

Though of only second quality, the attractive size and appearance and excellent shipping qualities of the Amri date have led to the development of a modest but very satisfactory export trade. The rather cool and foggy climate of El Qurein and Salhieh have led to the device which may be called the "pebble-floored drying yard" for fully utilizing the rather scanty sunshine and holding the heat at night. The yard is given a southern exposure, and surrounded on the north, east, and west by mud-brick walls about 8 feet high. The ground is then coated about 2 inches deep with brightly polished pebbles from half an inch to 2 inches in diameter, collected from the desert. On these pebbles the freshly gathered rutab dates are spread in a single layer, in neat beds with narrow walks between. (Pl. 9, A.) The heat reflected from the walls and stored in the pebbled floor greatly aids the curing in a climate where the autumn temperature is hardly sufficient for the ripening of packing dates.

At Birket el Haggi, though the culture of this variety is not so general as farther north, there are several features which differ from those there found. Pebble-laid yards are not provided, but the naturally sandy and gravelly surface, warmed by a somewhat brighter sunshine, affords ample heat for curing. At a large Italian-owned plantation called Roma, between El Marg and Birket el Haggi, the flat roofs of extensive warehouses and stables were utilized in drying the Amri dates, and a superior product was the result.

The crop of Amri dates was practically all in the drying yards or a large part packed and shipped at Birket el Haggi on October 12, 1921. There is an active demand for these dates in Liverpool and London, if early on the market, and they are rushed as much as possible.

The packing is rather carefully done in pine boxes made in the village shops. They are not uniform, but are about 54 centimeters (21½ inches) long, 26 centimeters (10 inches) wide, and 22 centimeters (9 inches) deep, and hold 40 to 50 pounds. At other villages boxes holding 60 to 80 pounds were used, and at Roma plantation the box used held about 140 pounds.

Brown (*3, vol. 5*), writes of curing Amri dates as follows:

When the bunches are taken from the tree the dates are picked from the shamrukh and spread on the ground on layers of small pebbles or reeds (samar gabali). They are allowed to dry from two to five days, according to the state of the weather. After this they are placed in a heap every night for a period of 8 to 12 days to heat and ripen. The ripe fruits are selected daily, and spread out into different classes, and packed in boxes containing about 40 pounds each. * * * About three-quarters of the total quantity is sent to England, where they are sold at a price varying between 12 and 30 shillings per hundredweight, the cost of transport, etc., being about 5 shillings per kantar (105 pounds).

HARVESTING, CURING, AND PACKING THE SAIDY DATE

The gathering and curing practices for the "Sewi" of Giza Province and the Saidy in its home in the Libian Oases are essentially the same, except that the size of the oasis package is adapted to the long desert transport by camel.

The Saidy palm is a rather heavy-bodied tree and does not reach the great height of the Amhat. Few of the oldest trees found in the

Giza district were more than 60 feet in height, with Amhat, said to be of the same age, 70 to 80 feet high. (Fig. 8, A-S.) But a tree 50 or 60 feet high calls for the climber with his gathering basket.

For gathering the Saidy fruit a basket is used much narrower and deeper than that for the Amhat, but it has the same stiff rim of hoop stuff to keep it open. (Pl. 9, B.) As the dates reach their deepest orange color before beginning to turn brown and soften, the climber strips them from the shamrokh (strands) into his suspended basket, usually leaving the calyx intact. The filled baskets are quickly lowered to the ground and emptied into other baskets to be taken to the drying yard, women and girls often in this way carrying 3 pecks or a bushel of fresh dates a quarter of a mile on their heads.

The drying yard is prepared by inclosing a level space of about a tenth of an acre with a high fence of arundo or maize stalks. (Pl. 10, A.) The more progressive growers lay down wide bolts of sedge-stalk matting, upon which the dates are spread about 2½ inches deep, fully exposed to the sun, and turned once in three or four days.

Much interest attaches to a knowledge of the temperatures to which these dates are exposed during the 12 or 14 days of curing. Data heretofore published (13, p. 27-32) warrant the following statement:

The mean temperature of Heluan, the nearest Egyptian weather station, for the month of October is 75° F., with a mean maximum of 84.6° and a minimum of 64.4°. Under full sun exposure the maximum would approximate 100°, but the mean for the full day is difficult to estimate. The 75 per cent of relative humidity for October at Giza would probably be approximately correct for El Hawamdiya and Bedrashen, where dew-point and morning fogs are very common at this season. These figures would point to slow maturation at moderate temperatures and rather high humidity as being better for the Saidy than higher temperatures and quicker action.

When ready for the pack, a large basket of coarse date-leaf braid is let into a hole dug to fit carefully its sides. A stout rope is passed beneath it to aid in lifting the heavy load when the basket is filled. The owner or the head gardener, with his horny-soled feet bare, as they usually are, steps into the basket, and his helpers bring the ripened dates in bushel carrying baskets and pour them in around his feet (pl. 10, B). The mellow and now somewhat sticky dates are very thoroughly tramped into a solid, air-tight mass, sealed with the slightly exuding sirup. The pressure against the sides of the hole keeps the basket in shape and prevents unduly stretching the rather weak braid. When filled to slightly rounding, the basket with its 300 or 400 pound weight of dates is pulled up, and a cover of the same spirally sewn braid is stitched on.

One by one these final products of the season's operations are ranged along the side of the yard and jealously guarded, day and night, until the buyer from Cairo comes to bargain for the crop. When the time comes to move them to the railroad, they are almost as hard as so much concrete. There can be no doubt that the slow curing which goes on inside this air-tight mass differs decidedly from the curing of a single-layer or a two-layer pack in a paper carton.

Aside from the insanitary handling and the lack of cleanliness, according to American ideals, the quality of this fruit, after an enzymic action has been in progress for 60 or 90 days, is unsurpassed.

A slight granulation of the sugar has taken place, and the somewhat cloying richness of the freshly ripened fruit has given place to something near a maple-sugar flavor through the development of certain ethers.

The preparation of the Saidy date of the Libian Oases for the valley markets is by far the older industry, and the following extract from Wilkinson (22, vol. 2, p. 357), information cited as gathered in 1824, throws interesting light on the oasis conditions of that day:

The modern name of the Little Oasis, the Oasis Parva of the Romans, is Wah el Behnesa²⁴—a translation of the old Coptic Ouahe Pemge. * * *

In this Wah are grown a variety of fruit trees, much liquorice, rice, barley, wheat, doora, clover, wild cotton (probably the remains of former plantations), and most of the usual productions of the Nile; but the principal source of wealth here, as in the other oases, is the date tree, which yields a very superior quality of fruit.

The dates are of four kinds: The Soltanee, the Saïdee, which are the best, the Kaka, and the Ertob (rottub); but those of the Siwah are even better. The proportion of fruit trees is also much greater than on the Nile.

A conserve of dates, called agweh, is made by pounding them in a mass and then mixing whole dates with it. The Saïdee are preferred for this purpose and are preserved in earthen jars and kept by the natives for their own use; but some, which they put into baskets, are sent to the Nile, where they are highly and justly esteemed. They are very sweet and rich, unlike any produced in Egypt, and are sold at \$5 or \$6 the kantar.

The sample obtained by Fairchild in Fayum under the name of "Wahi," described by Swingle (20), was from a bulk pack for camel transportation from Baharia Oasis (pl. 3, A) and was described in part as follows:

The flesh is yellowish, granular midway between the skin and the seed, and of a most delicious flavor. This date had been gathered and kept, with no precaution against drying out, for at least eight months when it was received at Washington, but was still in very good condition, except for the attacks of weevils. It seems to be a better keeper and to have a higher flavor than the Deglet Noor.

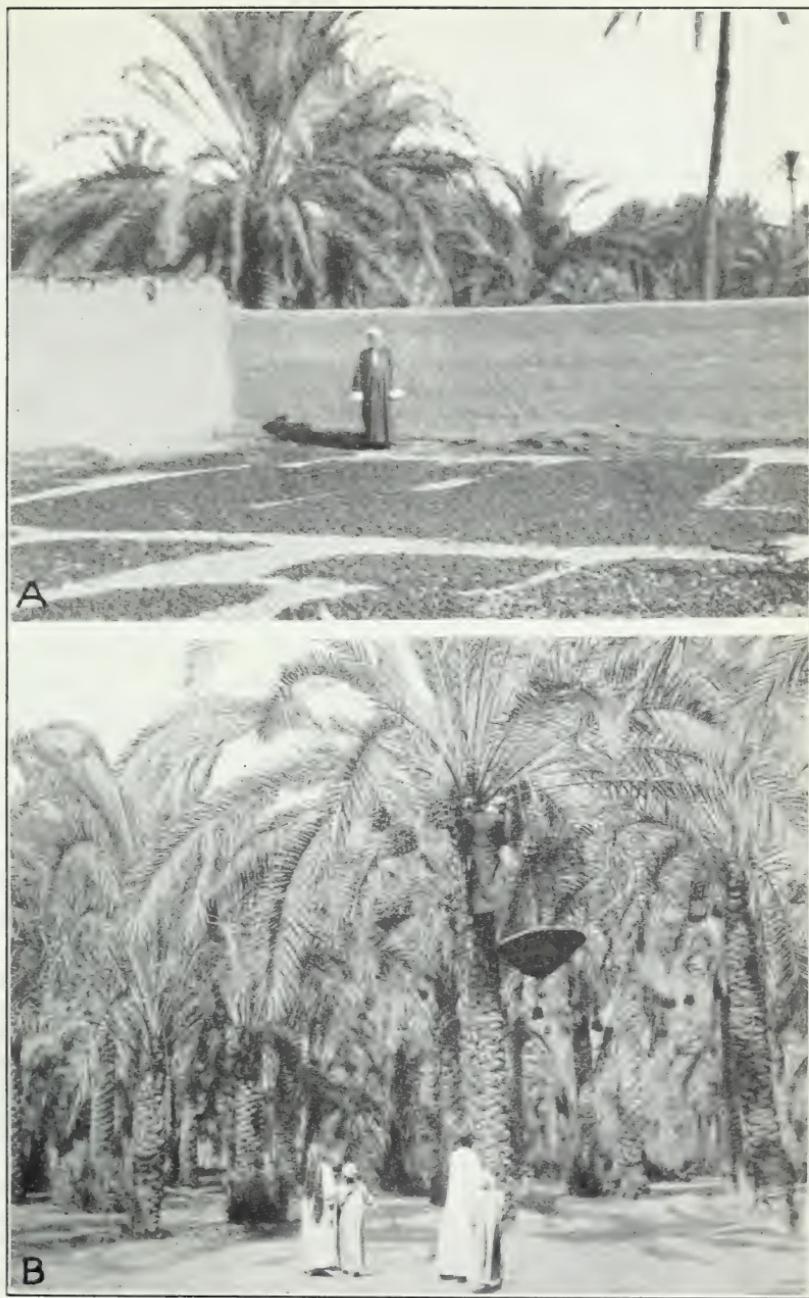
A sample of a special pack, put up for his own table by a well-to-do landowner above Giza, showed the "Sewi" at its best and was an example of what painstaking work might do to give this home-grown fruit a chance to compete with the "Dates Muscades," the second-quality Deglet Noor dates, which are brought into Cairo every fall from Algeria.

It is a very significant fact, in a commercial way, that even second-grade Deglet Noor dates, put up in fancy 1-pound packages or in 3-pound and 5-pound boxes, solid pack, will sell in limited quantities for three or four times as much in their own home town as the "Sewi" in a dirty and insanitary bulk pack.

In the fall of 1921 parties in Kharga Oasis undertook to make a trial shipment to London of the excellent Saidy dates of that oasis, famous in Egypt for more than a century. About 500 pounds were packed in neat 1-pound cartons, and an attempt was made at fumigation against the "Kharga moth," which deposits its eggs under the calyx of the unripe date.

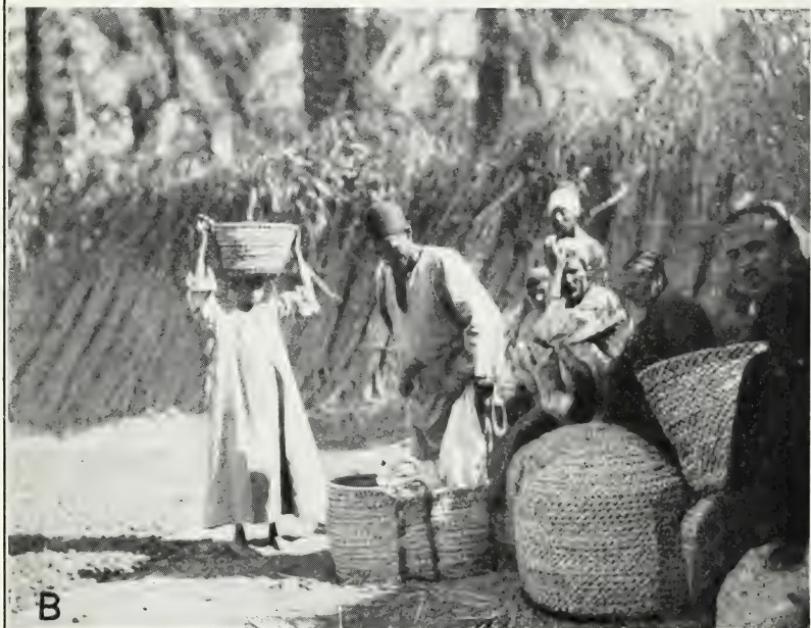
When the consignment reached Cairo, the dates were delicious and would have outsold anything on the market, but the fumigation had been unskillfully done, and a few weeks saw the boxes

²⁴ Now generally called Baharia.



CURING AND GATHERING DATES

A.—Pebble-floored drying yard at El Qurein for the curing of Amri dates
B.—Gathering Saidy dates near Bedrashen. These trees, growing on the site of ancient Memphis, are about 30 years old. Note the long fruiting stalks, characteristic of this variety. The fruit, when still hard but in its deepest orange color, is stripped from the threads into the baskets and spread for 12 to 14 days in drying yards



DRYING AND PACKING SAIDY DATES

- A.—A drying yard of Saidy dates near Bedrashen. The hard-ripe (rutab) dates are spread about $2\frac{1}{2}$ inches deep on strips of sedge grass matting, turned occasionally for 12 or 15 days, and then packed in bags.
- B.—Packing cured Saidy dates near Bedrashen. The tenant gardener here shown is packing the dates with his bare feet into strong baskets braided from date-leaf pinnae. The filled and covered baskets at the right hold about 400 pounds each.

alive with larvæ, so the London market was not invaded. It would appear that under the conditions of the air-tight bulk pack the moth eggs are unable to develop.

HARVESTING THE BARAKAWI AND IBRIMI DRY DATES

The harvesting of the dry dates of the narrow bit of Nile Valley from Korosko to Ibrim and of the Wadi Halfa region is about as simple a matter as gathering so much maize. The ripened branches are cut and dropped to the ground, and the hard, dry dates are stripped from them and piled in some court or compound until the time for marketing.

Under the later developments of the date trade, the crops are often contracted for in advance. The trader furnishes heavy burlap sacks holding about 320 pounds each. The packing of the dates in these is about as simple as sacking so much wheat or barley. The leading merchants affirm that if the dates are thoroughly sun dried and sacked promptly in sound tight sacks the danger from weevil infestation is slight. Dates from the Sukkot country may be run down the river at its flood in native boats at considerable risk of wreckage on the cataracts, or they may be sent to Wadi Halfa by the slower and surer means of camel transport.

Within the Dongola reach the sacked dates on barges may be towed by the post steamers to Karima for rail shipment to either Wadi Halfa or Omdurman. The camel men put up a strong competition for the trade from the river to Omdurman.

The overhead in the whole affair is reduced to a minimum. The Barakawi, which originated in the Sukkot region—hence often called “Sukkoti,” as it comes down the river—becomes the “Ibrimi” from Wadi Halfa and the old stronghold of Ibrim below Wadi Halfa and is so known all the way down to Cairo, but apparently any hard, dry dates of a common type are slipped in under this common name, and there are indications that many seedlings are produced which are close to the parent Barakawi type.

From Wadi Halfa about 4,000 tons of dry dates annually go down the river to Cairo and other Egyptian points. The Halfa merchants open the sacks as they come from the individual growers and dump the contents in huge piles in such a way as to get a uniform mixture. Some little attempt at cleaning and sorting is made, but the assertion is made that the trade does not warrant careful grading and classifying. This is from the standpoint of the merchant. It is the writer's opinion that the establishing and enforcing of grades for the leading varieties would greatly benefit the industry by stimulating better cultivation and handling on the part of the growers.

UTILIZING DATE-PALM BY-PRODUCTS

During the writer's first stay in Egypt in 1913–14, he was much impressed with the value of the date-palm products, other than the fruit, to the more than 11,000,000 Egyptians—an impression that has been deepened with each of the succeeding journeys since the World War. Most of these people are forced to live in a rather primitive way in a country wholly destitute of forests and with the greatest scarcity of fuel, either for manufacturing or for domestic

use. The consequence is that brick and tile burning are nearly unknown to the country, and the great mass of the people live in houses of handmade, unburned brick. But in any event a few sticks of timber and some roofing material are essential, and with the prohibitive prices of European timber the date palms are their chief source. Aged or unprofitable trees are cut or may be broken by the wind; sometimes a garden must yield to eminent domain for a railroad or a highway, and such trunks are all utilized to the utmost. Door and window caps and floor joists for the more pretentious houses, with overhead joists for the flat roofs, are provided by quartering and hewing good-sized trunks. Then for flooring or roofing a thick layer of leaves with the pinnæ intact is laid down and covered with well-packed mud.

These examples are only a few of the many uses to which the parts of the date palm are applied. Table 3 gives an outline of many of the uses to which materials from this tree are put.

TABLE 3.—*Date tree by-products, showing examples of useful application of materials other than the fruits*

Classes of material	Uses
Sap.....	Fermented and distilled liquors. Not now permitted by law.
Tree trunk as timber.....	Floor and roof joists, lintels, sakieh frames, water conductors, light bridges, rustic work.
Leaves:	
Entire leaves.....	Fence building; palisades around housetops; spread thickly on joists to support a layer of earth for floors or roofs.
Leef (sheath fiber).....	Small cordage; ropes; burden nets for camels and donkeys; reinforcing for baskets; brush brooms; pads; packing material.
Pinnæ.....	Basket making: By flat braid sewed into form; by wrapped coil weave, like the Pima baskets of Arizona; baskets for a great variety of uses, such as marketing produce, handling coal, earth, sand, and street rubbish; small cordage (called habl sarraff), mats, pads, fans, fly flappers; sakieh ropes in Upper Egypt and the Sudan.
Rachis or rib (gerid).....	Crates, racks, trays, drums, or stands; crates for every conceivable use, such as transporting poultry, eggs, fruit, vegetables, pictures, glass, mirrors, light fixtures, and pottery.
Sobata (fruitstalks), including the shamrokh, or fruit-bearing strands.	Sakieh ropes: The macerated stalks have the fibrovascular bundles separated and twisted into very firm cord and strong rope for tree-climbers' girdles, saddle girths, etc.; cores for the wrapped spiral-weave baskets.

It is not for a moment supposed that most of these uses could be profitably applied in American date-growing regions, where the vast resources of this country in sawed and dressed lumber, brick and tile, lime and cement, wall board and patent roofing, metal lath, and sheet metal are at the command of the humblest builder.

With the price of a day's labor from 6 to 10 times as high in America as in Egypt, it is not possible that much of the handicraft that has grown up around the date-palm products in that land can find profitable application here. The hand twisting of cordage from leef (the fiber of the great sheath at the base of each leaf) and the plaiting of basket braid are old-age occupations in a land where old age seldom brings leisure (pl. 3, B, and pl. 4, A), and the immense number and endless variety of crates made from the strong and elastic midribs of the leaves are only produced at a profit by the native methods with labor at 7 to 10 piasters a day, the equivalent of 35 to 50 cents in American money.

The chief available by-product of American date palms will probably be the leaves, 12 to 20 of which are pushed out of the great

terminal bud each year. It follows that an equal number of the leaves below should be pruned off each year, in order to keep the dying leaves out of the way and to keep the blossoms and fruit, which are produced within 6 to 8 leaves of the top, within reach of the cultivator.

With an average of 12 leaves each on several hundred thousand trees to be removed annually as a necessity, it becomes an important economic problem whether they are to be treated as so much rubbish to be carted out and burned or whether, under American labor conditions, they can be made to serve some useful purpose and at least pay the cost of their removal.

MAKING CRATES FROM LEAF MIDRIBS

The most obvious use of date leaves in America would be the manufacture of the strong midribs, or "gerid" as the Egyptians term them, into crates. The variety of sizes and shapes of crates made by the native craftsmen of Lower Egypt is almost innumerable. There is one variety of crate for your luncheon as you go out from your hotel to spend the day at the pyramids or at Saccara; two braces of quail or pigeons may be hawked about the streets in a little crate of another pattern; while a donkey may be passing with two double-decked crates loaded with geese balanced over his back. Again, a heavy, specially made crate of selected midribs may constitute the entire bed or body of a 4-wheeled truck loaded with early melons, followed by a similar truck with a dozen crates filled with eggs packed in dry sugar-cane leaves. Whatever may be the demands in America for light or moderate-weight packing cases, the Egyptian has a substitute, and a very good one, made from the inevitable gerid of the date-palm leaf.

The adaptation of the crate-making craft to the needs of the highly specialized agricultural industries of Fayum, described elsewhere in this bulletin, is a most instructive example of such possibilities. The weight that may be inclosed in them is not insignificant. The writer's later shipments of about 9,000 date-palm offshoots were packed at Giza in nearly 400 specially designed crates of selected stock, mostly from the leaves of the Amhat and Saidy varieties of date trees, costing about \$15 a thousand. These crates were 48 inches long, 26 inches wide, and 26 inches deep, inside measure. Their construction is shown in Plate 4, *B*. The sides and ends are each composed of 17 rails, or horizontal pieces, in two groups of four and three groups of three each, with an extra one around the bottom forming a panel. The bottom and lid comprise 10 rails each.

These rails were punched with a total of 1,152 holes for putting in the vertical spindles, of which there are 48 in the sides and ends and 16 each in the top and bottom. These crates were packed with an average of 20 offshoots each, moist leef being used for packing. They weighed, ready for shipment, about 400 pounds. The cost of this style of crate delivered at the packing sheds in lots of 50 was close to 45 piasters, or about \$2.25 in United States money. An equivalent crate made of 3-inch pine or fir strips with doubled ends would have required about 35 feet of lumber, costing \$3.50 in that country, without nails or labor. But with lumber the same strength and elasticity would not have been obtained.

On account of the long voyage before them the packed date-palm crates were wrapped with $\frac{1}{8}$ -inch galvanized wires, four lengthwise and three around the short circumference. The endurance test of one shipment of 190 crates was about as follows:

They were carted from the packing shed to ricks in the storage yard, rolled on skids two tiers high on drays, carted 2 miles to the railway platform and dumped, none too gently; packed two deep in the small closed railway tracks and hauled to Alexandria, where they were discharged at a suburban freight station for another cartage, this time 3 miles, to the docks. After a brief but trying experience with the cargo derricks they were stored two tiers deep on the shelter deck of a staunch United States Shipping Board freighter bound for New York and had a peaceful voyage of 20 days before they were dragged out and dumped on the Brooklyn docks.

After a phenomenal transfer by motor trucks halfway across the city they had the unheard-of good luck to be placed the same day on a freighter bound through the Panama Canal to San Pedro, Calif. After the usual discharging experience at the San Pedro docks they were transferred to freight cars for Indio. One more contact with a freight platform, a 2-mile truck ride to the United States Experiment Date Garden, and the journey was ended. The astonishing thing is that only one or two crates were so broken as to spill any of their contents, and that the most of them arrived in really good condition after 15 transfers.

In preparation for crate making, the midribs, stripped of their pinnae, are placed in the sun to season a little, but they must not be allowed to get at all hard and dry. They are then cut into lengths, measured by stock forms according to the type of crate under construction, the straightest and best portions of the rib being selected for the long rails for the top and bottom groups of large crates, the heavier butt pieces being split to convenient sizes, and the more slender top cuts used for the vertical spindles. The rail pieces are then prepared for punching by shaving off the sides to which the pinnae were attached until two parallel flat surfaces of the pithy interior are exposed. A "jig" or form already punched is laid on the upper face and the points for the holes marked with a blunt prickpunch.

The most interesting operation is to follow, the rapid and almost automatic punching of the $\frac{1}{2}$ -inch holes with the long, hollow punches shown in Figure 6, D, E, F. Seated on the ground, with a block of wood in front of him, the workman places one of the marked strips across the block and grips it with his toes. With his left hand he holds the punch in position, while with the right he gives a sharp blow with the billet of wood which serves as a mallet. While the punch is firmly embedded in the stick he slacks the grip with his toes, moves the stick along one space, grips it again, loosens the punch with a quick twist and a tap of his mallet, and applies it to the next mark, to repeat the operation. So perfect is the coordination between hands and feet and so rapid the blows that the stick moves across the block with almost machinelike speed.

In assembling the pieces into the finished crate no small skill is required, though this is work usually done by boy apprentices. The bottoms are first put together, with the overlapping corners pinned together by driving in the vertical corner spindles, then all the spindles are driven into place and the side and end rails with the holes ready punched are driven on to them, the skill consisting in keeping them accurately spaced and grouped. The covers are

put together separately, where covers are used, and lashed on after the crate is filled. In offshoot packing both bottoms and covers were made secure with loops of stout wire, as the inside pressure tended to force the sides and bottoms apart where the spindles went through the holes in the rails. The permanent carrying crates used by the natives on their camels, donkeys, and carts are reinforced with wrappings of the handmade cord from the leef fiber.

POSSIBILITIES OF CRATE MANUFACTURE IN AMERICA

These details of the native methods of manufacture are given here to afford suggestions as to the requirements to be met under American adaptations and conditions.

In southern California, in the date-growing districts, the chief product calling for special containers is the Berinuda onion crop, which is packed in bushel folding crates of the Cummer type. The 1924 acreage in the Coachella Valley was approximately 1,400, requiring an average of 300 to 400 crates to the acre, or about 500,000 crates.

Each crate requires in construction 36 linear feet of stock five-eighths by seven-eighths inches, besides the top and bottom of three pieces each, one-fourth inch thick by 3 inches wide. To make the whole crate of date-leaf midribs would require approximately 60 linear feet of stock of similar diameter, which would be furnished by 10 or 12 average leaves; that is, the annual prunings from each bearing date palm would furnish the material for one crate or container of 1-bushel capacity. Some trees with extra-long straight leaves would do much better than that, but one crate per tree per year would be a conservative estimate.

The writer has recently constructed two crates modeled after the folding onion-crate pattern from ribs of date-palm leaves grown at the United States Experiment Date Garden, Indio, Calif. (pl. 11, A). Ordinary carpenters' tools were used, and the time consumed was naturally out of proportion to the regular price of factory-made pine crates of this pattern. In appearance and utility they are fully up to the standard of factory-made crates, while in durability they are much superior. Whether with the use of light wood-working machinery for cutting the midribs to proper lengths, dressing to size, and boring the holes for the corner wires such crates could be made at prices to compete with the factory-made crates now brought in from the Southern States can be demonstrated only by actual trial.

With a planting of 50 trees to the acre, which is the usual number, 10,000 acres of date palms would furnish, as an otherwise waste product, leaf ribs enough to make crates for the average onion crop of the valley. At present rates of increase such a date-palm acreage will soon be reached and passed. When we consider the enormous development of the cantaloupe and lettuce industries in the Imperial Valley, we see a possible demand for special crate manufacture for all of the date-leaf ribs that may be produced with the largest development of date growing that can be looked for in that and the Colorado Valley.

Another type of crate to the making of which the date-leaf ribs are especially well adapted is that for shipping live poultry. The

Egyptians anticipated this want long since. Plate 11, *B*, shows a number of double-decked poultry crates seen on the railway platform at El Marg. The live-poultry industry is a thriving one in California, and material for the construction of good crates, at once airy, light, and strong, is continually becoming scarcer and advancing in price.

FURNITURE FROM LEAF-RIB MATERIAL

Egyptian workmen show much ingenuity in making household furniture from the higher class date-leaf ribs. Very comfortable benches, settees with high backs, couches, and even tolerable bedsteads are all made on the rail-and-spindle principle, but with the rails crowded close together. Very neat taborets and stools of a variety of forms are also made. American taste and ingenuity would readily contrive a variety of styles of serviceable and attractive bungalow furniture from this material.

Of course, in any such construction undertaken under American labor conditions, advantage would have to be taken of the light machinery with which our woodworking and furniture shops are so well equipped. Several types of machines now in use would need only a slight adaptation to answer for this work. Others might be devised as the needs of the work developed.

COMPARATIVE HEIGHT OF EGYPTIAN DATE PALMS

The magnificent height of the date palms in the Nile Valley is one of the first things to attract the attention of the visitor. Especially along the Nile bank on the Gизera below the Kasr Neil bridge and again above the Giza station the high, clean trunks of the palms show in sharp relief above the river surface. In connection with a survey of the distribution of the three chief commercial varieties—the Amhat, the Hayany, and the "Sewi" in the vicinity of Cairo—an attempt was made to measure enough trees of a series from youngest to oldest to permit the plotting of growth-rate curves.

At best, in a country like Egypt, with few records and much left to memory and tradition, only approximations of the ages of the older trees are possible. With information that a certain garden was planted as a part of the palace grounds for Ismail Pasha or Sultan Hassein the age of palms in that garden is not hard to estimate, but when one aged man asserts that certain palms were planted by his grandfather and were "tauwil" (high) trees when he was a little boy, the age for those trees is a matter for judicious approximation. The relative growth rate of two varieties grown together is more reliably compared, provided they were planted at the same time.

A variety may grow very rapidly for the first 10 or 15 years and thereafter decline in growth, attaining only a moderate maximum height in the end, while another may sustain a relatively rapid growth rate for many years.

To carry out the measurements, an expert tree climber was employed—one familiar with the neighborhood when possible, whose acquaintance with owners or head gardeners and knowledge of local traditions would be of most value. A 100-foot metallic tape was used, the ring carried to the top of the highest visible sheath or leaf, and drawn taut to the ground surface. Diameter measurements at 4 feet from the ground were made on most of the trees.

THE AMHAT AND SAIDY GROWTH CURVES

The Amhat date palm is found reaching great heights in larger numbers than any other variety in Egypt, and it may be questioned whether there is another variety that will equal it in the date-palm world. Plantations of several acres in extent were noted which from sample trees measured averaged 75 feet high, while 10 trees were found measuring 80 feet or over, figured at the top of the last sheath, considered to represent the tip of the bud and hence the top of the trunk. Two trees near a stone mill back of El Hawamdiya measured 90 feet 7 inches and 92 feet 5 inches, respectively, and another 82 feet 10 inches. These trees were famous throughout the upper Giza

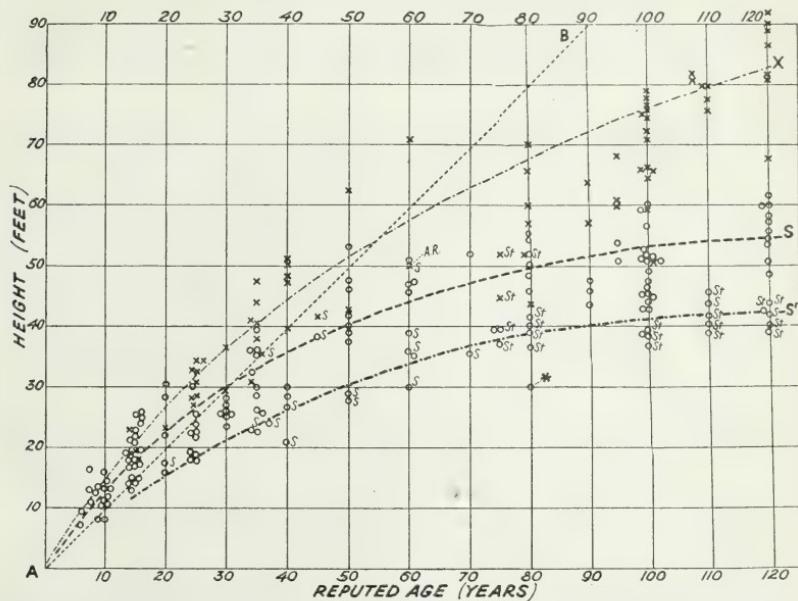


FIG. 8.—Diagram showing the comparative rate of growth in height of Amhat (x) and Saidy (o) dates in upper Giza Province: A-B=Theoretical growth of 1 foot a year; A-X=average growth of Amhat, often associated with the Saidy in the same gardens; A-S=average growth of Saidy under best conditions; A-S'=average growth of Saidy in rather poor sandy or salty soil; S=sandy soil; St=salty soil; * =bad alkali. Each circle or cross represents a tree measured. The ages of the trees shown in 10-year periods at the bottom are the closest approximation to the ages of the trees measured that could be obtained from the owners

country, and the first two are probably the tallest palms in Egypt. Figure 8, $A-X$, shows that up to 40 years of age the growth rate of the Amhat date is considerably more than a foot a year, that the rate at 55 years is a foot a year, and that the curve advances at more than three-fourths of a foot a year up to 100 years and is still going strong at 120 years.

When it is understood that these palms have an average trunk diameter of only 18 or 20 inches, the grace and beauty of these old Amhat groves can be more fully appreciated. (Pl. 12, A.) It should be mentioned also that the wood of the Amhat trunks is of unusual hardness and strength, which explains their being able to attain such great heights.

The growth rate of the Saidy date (Sewi in Giza) differs in a very marked way from that of the Amhat. Up to 20 years of age the two varieties, often planted in mixed gardens, hold close together, both growing with great vigor. At 25 to 30 years the Saidy, although no less vigorous, falls rapidly behind the Amhat in height gains, but is notable for its sturdy trunk and splendid crown of long outcurved leaves. (Pl. 2 and pl. 9, *B.*)

The difference in growth is shown in Figure 8, *A-X* and *A-S*. In the columns of 100-year and 120-year trees many of the individuals of the two varieties were growing in the same gardens and were said to be of the same age. It will be noted that the greater number of the Saidy trees reported to be 100 years old were between 45 and 55 feet in height, while the Amhat at the same age ranged between 65 and 80 feet. Only four Saidy trees were found of the extreme age measuring 60 feet or over, the highest record being 61 feet 10 inches for a tree near the little village of Umm Khanan.

A very significant supplemental curve (*A-S'*) is shown in Figure 8 for the Saidy from plotting the mean growth of about 30 trees found either in sandy land (marked *s*) or extra salty land (marked *st*). Contrary to the usual impression in America that date palms prefer a somewhat alkaline soil, the best palms in Giza Province were observed on land of fine quality, capable of producing good crops of grain or sugar cane. Date palms were seen growing and producing remunerative crops on land too salty for profitable general agriculture and on heavy land showing strong salt efflorescence and needing drainage, but such trees were not at their best. The Saidy in the Kerdaseh district on rather thin sandy land furnished the specimens marked *s*. Here the factor of water scarcity may also play a part. This strip of country is above the line of gravity canals but in one of the few remaining flood-basin districts. During the dry season the trees are watered rather scantily from wells.

In a section a few miles west and northwest of Cairo, generally in crop cultivation but with many scattered palm gardens, some of the oldest Saidy trees in the valley are found. On the better soils they have reached the maximum height for their age, but where the soil is strongly salty the falling off in height is very marked. As an example: At El Baragil, in heavy salty land, 3 average Saidy trees of a group of 17 said to be about 100 years old measured 42 feet 9 inches, 46 feet 7 inches, and 43 feet, with Amhat trees near by, said to be of the same age, running to 72 feet 5 inches. At El Maatemdiyah, in a group of trees estimated to be from 100 to 120 years old, on heavy salty land, sample trees ran to 40 feet 7 inches, 39 feet 7 inches, 41 feet 6 inches, 38 feet 11 inches, 42 feet 2 inches, and 45 feet 9 inches. The best Amhat tree near by reached 68 feet.

From these figures it may be inferred that the Saidy is more sensitive than the Amhat to alkali in the soil. In general, the Saidy appears to suffer more from advanced age than the Amhat, and it may prove to be a somewhat shorter lived tree, though generally trees up to 75 years of age were still bearing well.

THE HAYANY GROWTH CURVE

The Hayany, the most numerous date palm of Lower Egypt, makes a rapid height growth during its early years, though scarcely equaling that of the Amhat and Saïdy, but its curve flattens rapidly after it is 40 or 50 years old, and few trees reach a height of 60 feet (fig. 9, A-H).

A tree 60 feet high growing near a shallow well in El Marg evidently had its roots in permanent soil water. It was reputed to be

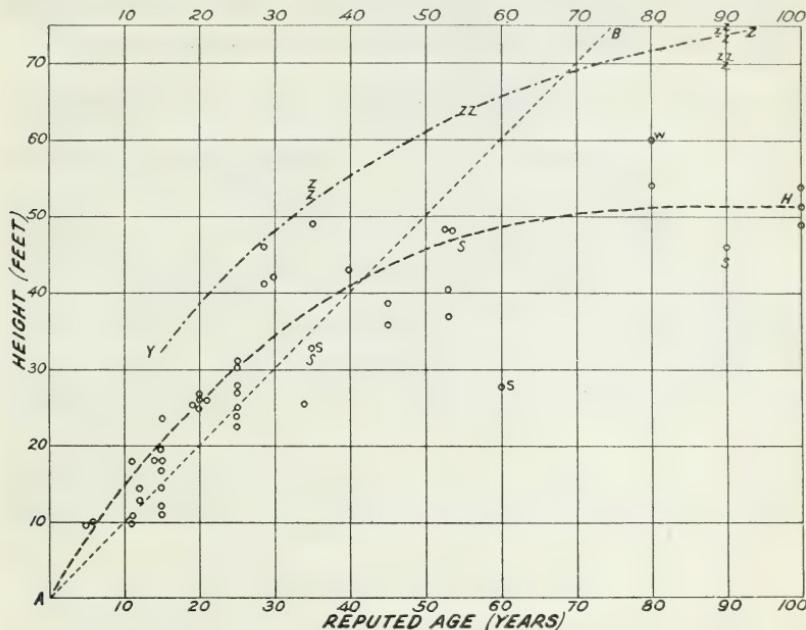


FIG. 9.—Diagram showing the comparative rate of growth of Hayany (o), Samany (s), and Zagloul (z) dates: A-B=Average growth of 1 foot a year; A-H=average growth of Hayany; Y-Z=average growth of Zagloul; os=Hayany trees in very sandy soil; ow=Hayany tree near a well (ground water near surface). The growth curve of the Hayany is shown as about keeping pace with the Amhat and Saïdy up to 40 years of age and with the Saïdy up to 50 years of age, after which the curve flattens rapidly, and very few of the Hayany trees were found more than 50 feet high. A small number of Zagloul trees which were measured indicates a growth vigor for this tree perhaps equaling that of the Amhat. Most of the Hayany trees were measured in the El Marg district and in Kerdaseh. Compare with Figure 8.

80 years old. On sandy ground east of El Marg a sample tree of a group reported as very old—100 to 120 years—was only 54 feet high. A balady (seedling) tree grown under similar conditions and said to be of the same age was 67 feet high. This is strong circumstantial evidence, at least, that the slender trunk and shorter growth of the Hayany are varietal characteristics and not due to the rather light soil of this neighborhood. In rather lean sandy soil near Kerdasch two Hayany trees 51 feet 2 inches and 49 feet 3 inches high, respectively, were classed as being 100 years old. A Saïdy tree growing near and said to be of the same age was 43 feet 4 inches high, and two Amhat trees were 64 feet 9 inches and 66 feet, respectively. The Hayany has a trunk more slender than either of the other two

varieties, and the grace of its feathery leaves makes a grove of these trees at 30 or 40 years of age a peculiarly attractive sight. The lack of aged trees in the El Marg district and the preponderance of trees 15 to 40 years old points to the rather recent development of the market for rutsâd dates in Lower Egypt. This palm is at its best around El Marg, where the ground water is not far below the surface, but it seems to have the ability to send its roots deep down, for above Ramleh, near the coast, are many trees which receive no irrigation and depend for water on the soil moisture 15 feet deep. These trees are making only a moderate height growth but bear profitable crops.

THE HEIGHT GROWTH OF THE ZAGLOUL AND SAMANY VARIETIES

The Zagloul date is said to have originated in the vicinity of Rosetta, or "Rasheid" of the native nomenclature, and is one of the most valuable and striking varieties in Lower Egypt. Only trees of considerable age are to be found around Cairo, and these are chiefly in former palace gardens. The heights of the specimens measured from three groups of trees said to be 35, 55, and 90 years old, respectively, are plotted on the same sheet with the Hayany. The incomplete curve (fig. 9, Y-Z) shows this to be one of the palms of most rapid growth, with a sustained growth rate equaled only by the Amhat.

The Samany, another highly valued though not abundant date of Rosetta origin, has been planted in small numbers around Cairo and has a growth habit strikingly different from that of the Zagloul. Its height growth is slow, the trunk stout, with a heavy crown of extra-long leaves which sometimes reach 16 feet. The locations of three specimens measured are marked *s* in Figure 9 and indicate a growth curve close to those of the Saidy and the Hayany.

THE TREE-CLIMBER'S CRAFT

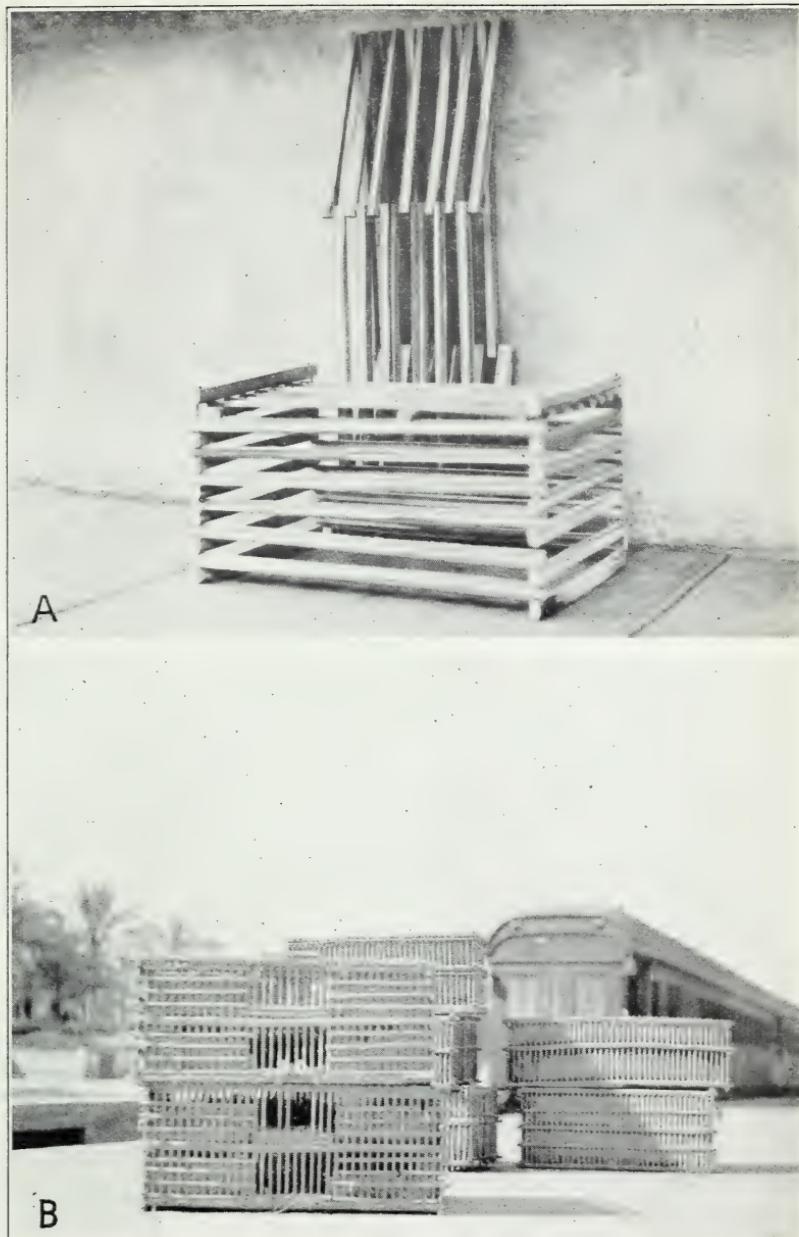
The imposing heights reached by Egyptian date palms, even by varieties of such modest growth as the Hayany and the Saidy, point to the conclusion that the craft of the tree climber must be transferred to the United States along with other features of the date industry. It need not follow that all the details of the craft should be copied here, any more than that we should adopt their methods of pruning and the use of the sakiéh in irrigation.

The fact must be faced that a great many American date palms are rapidly outgrowing the stepladder stage and that some other method will soon have to be adopted for reaching their tops.

At the Arizona Agricultural Experiment station at Tempe and at the former experiment-station garden west of Phoenix, now private property, are the oldest and tallest imported date palms in the United States, many of them being from 25 to 30 feet high.

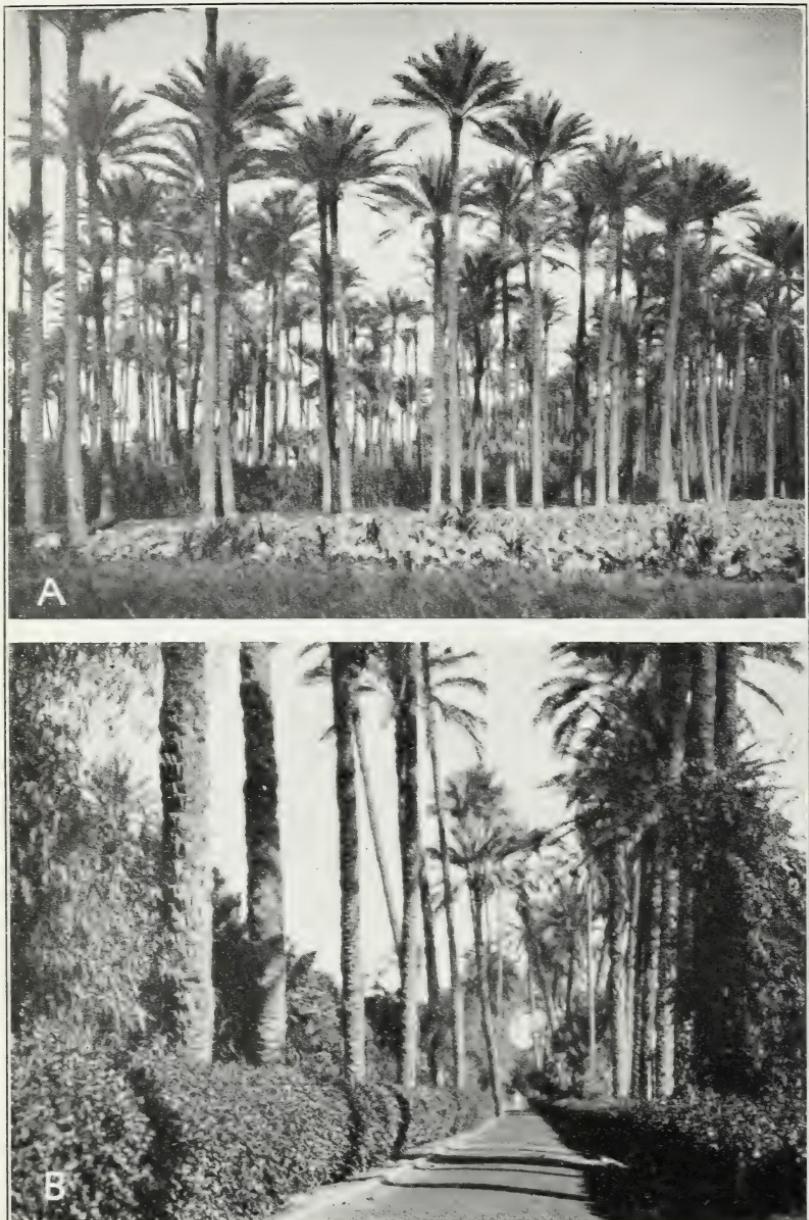
Here 20-foot ladders, and some 25 feet or more, are needed. Moving such a ladder to different positions around the tree or from one tree to another becomes a task for two men and suggests the question whether the cultural work could not be more easily and efficiently done by the climber's methods.

The use of extension ladders on wheels has been suggested, but they are likely to prove entirely too cumbersome, especially in soft,



CRATES MADE FROM DATE-LEAF MIDRIBS

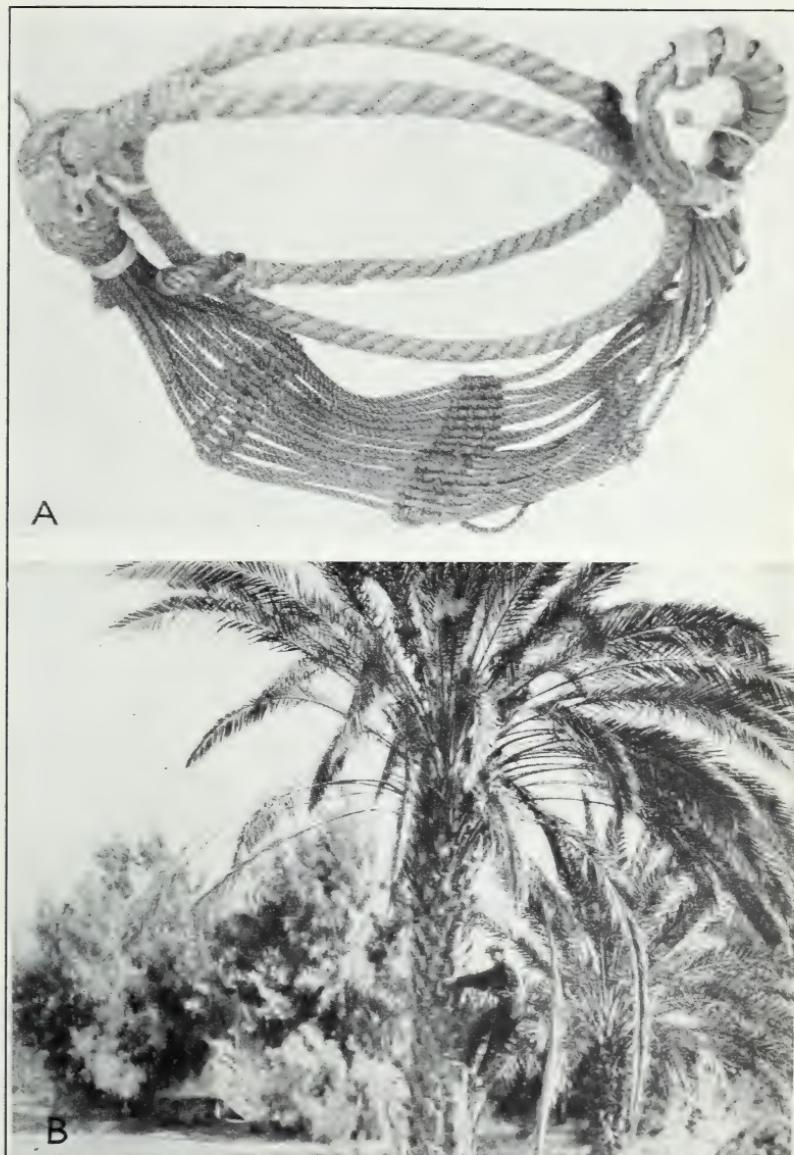
- A.—Folding type of shipping crates made from date-leaf midribs. The crates here shown are such as are used for packing onions in the Coachella Valley in California. They were made by hand from material grown at the United States Experiment Date Garden, Indio, Calif.
- B.—Double-decked poultry crates made from date-palm midribs. Photographed on the railway platform at El Marg, Egypt, in 1921



DATE TREES ALONG THE NILE

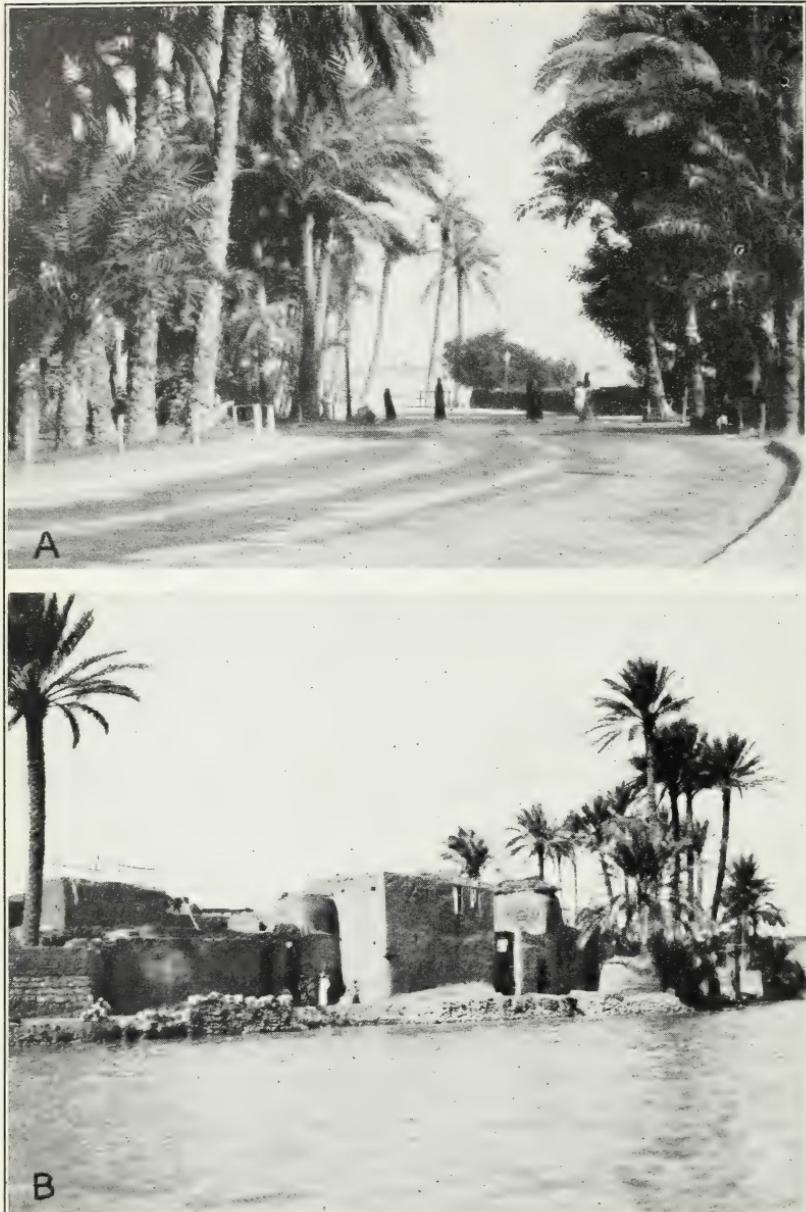
A.—Plantation of Amhat date palms on Nile bottom lands. These palms growing near Giza average about 75 feet high at 100 years of age and are still in vigorous bearing. The Amhat is the tallest growing date variety in Egypt

B.—A picturesque walk along the Nile bank. This border of date palms, formerly part of a palace garden, is now a part of the public park system of Cairo. The trees are more than 75 years old



TREE CLIMBING AND EQUIPMENT

- A.—An Egyptian tree climber's rope and girdle. This beautiful cord and rope is made by hand from the fiber bundles of the fruitstalks and fruit-bearing strands of the date tree. (About one-eighth natural size)
- B.—First use of an Egyptian tree climber's girdle in the United States. Fred N. Johnson, one of the pioneer date growers of the Coachella Valley, Calif., is here shown climbing a date-palm tree. Photographed at Indio, January, 1924



LANDSCAPE POSSIBILITIES OF PALMS

- A.—Boulevard around the upper end of the Gizera. Commanding magnificent views of the Nile and of Cairo across the river, the flanking groups of old date palms show the landscape possibilities of this beautiful tree
- B.—View in Kerdaseh, an Egyptian village, at the time of the Nile flood. The bare mud-brick buildings shown are redeemed from utter ugliness by the background of this little grove of date palms

sandy soils, aside from the difficulty of inserting the ladder top among the leaf bases.

Already the growers in charge of some of the older California date palms have abandoned the use of ladders and are climbing their trees with only Nature's equipment of hands and feet. This is hazardous and does not leave the hands free for work at the top.

In contrast, the oriental climber, secure in the support of the broad girdle at his back, can circle around the tree with both hands free for pruning, pollination, or fruit gathering, and remain aloft for an hour or two if necessary.

The height measurements, shown in Table 4, of the oldest date trees growing near Indio in the Coachella Valley indicate the approximate age at which date palm trees are likely to exceed the height at which the use of ladders in cultural operation is practicable.

TABLE 4.—*Height of date-palm trees near Indio, Calif., according to measurements made in November, 1923*

[Other trees nearly as old had the leaves cut off for transplanting or to kill *Parlatoria* scale and so are not directly comparable with these]

Locality and variety	Year set	Age	Height to top of bud
		Years	Feet
Fred N. Johnson's date garden, Indio, Calif.:			
Deglet Noor.....	1905	18	27
Do.....	1905	18	26½
Do.....	1905	18	24½
Do.....	1905	18	25
Unknown.....	1905	18	18
Durbrow ranch:			
Rhars.....	1900	23	23
Do.....	1900	23	24

It will be seen that the growth ranges from 1 to 1½ feet annually. These figures, together with the growth curves plotted from Egyptian measurements (figs. 8 and 9), show that a height of 20 feet is reached by the general run of date palms at 15 to 25 years of age, according to varieties and soil and water conditions.

A tree 20 feet high has reached the point where the use of ladders is no longer profitable, and some adaptation of the climber's methods should be put into practice.

The telegraph lineman's climbing irons and strong leather belt are familiar enough to most Americans, but the ordinary steel gaffs would not take the secure hold on the date-leaf bases that they do on a solid spruce pole, and if the gaffs were larger they would make unnecessary blemishes on the tree trunks.

The 7-inch girdle with 16 or more pliable quarter-inch strings, so carefully made by the Egyptians (pl. 13, A), certainly offers greater comfort for a prolonged stay in a palm top than the hard leather belt in use by linemen. Such handwork is not to be had in this country, but a very good substitute is readily obtained in the cinch, or girth, sold for heavy stock saddles. The best girths are about 6 inches wide and are made by using 20 to 26 triple-strand horsehair or cotton strings. These are knotted into a heavy iron ring at either end. The type with three crossbars is the most serviceable.²⁵ With

²⁵ Horsehair strings are liable to prove rather prickly without a lining.

10 feet of $\frac{7}{8}$ -inch or 1-inch best manila rope an eye-splice should be made into the left-hand ring of the cinch, and the free end should be well wrapped to prevent fraying. To the other end of the cinch should be attached a heavy iron snap, such as is used on the breast straps of wagon harness, the tongue of the snap toward the outside.

Three or four trace-chain open links should be fastened about 8 inches apart into the outer end of the manila rope and closely closed. The common harness rings are too fragile to be trusted with a man's weight. A light strap or thong fastened to either cinch ring and passed in front of the shoulders and back of the neck should be of the proper length to keep the girdle in the most convenient position across the back. Putting on the girdle and throwing the rope around the tree trunk, the operator catches the free end in his right hand and, testing it for convenient length for climbing, slips one of the links into the snap.

To place the feet against the leaf bases and support the body with the girdle against the back is simplicity itself; but to throw the weight of the body off the girdle and get slack enough on the rope to permit its upward flip on the opposite side of the tree is accomplished only with practice. The photograph shown in Plate 13, *B*, taken at Indio, Calif., in January, 1924, represents probably the first attempt at date-tree climbing by the Egyptian method ever made in America.

LANDSCAPE VALUE OF THE DATE PALM

To one who has traveled in the date-growing regions of the Old World, the landscape effect of the date palms is one of the first impressions received and one that grows with every day spent in the region. Young palms before the age of trunk elongation begins have a certain artistic beauty derived from the crown of outcurving pinnae leaves, and as fruiting begins this is enhanced by the beauty of the heavy clusters of brilliantly colored fruit seen against the background of gray-green foliage.

But it is only with advancing years that the real dignity and beauty of the date palm, which cause it to be the dominating feature of any landscape, are established. Even then the date palm is at its best only in groups or groves. Singly, its trunk is too slender to give the impression at once of grace, of beauty, and of strength. A single architectural shaft or column is exceedingly difficult to design, needing the nicest balance in proportions of shaft, capital, base, and pedestal to give the idea at once of beauty and stability; yet the simplest columns in groups or colonnades at once support one another in producing the most beautiful effect. So a single old palm with its slender trunk, often out of perpendicular, and its lack of base is apt to give an impression of precariousness and lack of balancing. But groups or regular rows supporting one another in a colonnade effect give a most pleasing impression. At the same time tall detached palms among broad-leaved trees and shrubs or among buildings give a note of picturesque beauty which nothing else affords. Whatever the situation—whether in city parks, in villages, along wide alluvial bottoms, or in groves around some group of desert springs—the date palm dominates the landscape. It sounds the key-

note; all the other features must harmonize with it and are subordinated to it. It is a note wild, half barbaric, tropical, yet full of sweetness and mystery.

Plate 12, *B*, shows one of the most beautiful promenades around Cairo. This walk is along the western bank of the Nile, between the Kasr Neil and Bulak bridges, and was formerly a part of the palace grounds of one of the khedives, but is now part of the public park system of the city. The trees are unequal in height and their tall columns are not perfectly vertical, but their inequalities balance one another, and the whole effect is one of impressive beauty. These trees are about 75 years old, and the beauty of their foliage is enhanced by their heavy crops of fruit. The sale of this fruit, by the way, yields much toward the cost of the care of the trees and walks.

Another of the landscape treasures of Cairo is shown in Plate 14, *A*. Here a magnificent paved boulevard sweeps in majestic curves around the upper end of the "Gizera," or island. This drive commands views in turn across the Nile to the Cairo side, with its walled-in palace gardens and anchored pleasure boats; up the Nile to the dimly defined arches of the great Mohammed Ali bridge; and across the broad canal mouth to the Giza bank of the Nile with its other rows of garden-embowered palaces and villas, where feathery palm tops cut into the sky line. These views are not disclosed all at once, but are framed, as it were, between the bordering groups of palms, which give emphasis to the sweeping curves of the drive.

In California the new highway system of the Coachella Valley alone comprises many broad curves and triangles where, after safety first is remembered and a clear view insured, bordering groups of palms planted this year would pay heavy dividends in the enhanced beauty of these valley highways in the years to come. There might even arise a "Landscape Art Association" with chapters in different counties, working in collaboration with the highway commission in beautifying the public roads. In the Coachella and Imperial Valleys of California and in the Colorado, Gila, and Salt River Valleys of Arizona the date palm would prove in the hands of such an organization one of the most effective plants that could be used.

Plate 14, *B*, gives an idea of the beautifying effect of a few date palms. Here is seen a little village, or esbet, a few miles from Cairo. Its mud-brick houses, almost destitute of windows, are redeemed from utter ugliness only by the picturesque group of date palms of varying heights on the right and the single tall male palm at the left. Rising amid such surroundings the unsightly aspect of the buildings is forgotten in the grace and beauty of the setting.

While the sight of such strange and weird plants of the American Desert as the giant cactus and the Joshua tree enhances the idea of desolation and offers only elusive hope to the exhausted and thirst-haunted traveler, the sight of a distant grove of date palms in the most remote desert suggests water, shade, and rest—perhaps food and hospitality.

The transplanting of the date industry from North Africa and Mesopotamia to southern California and Arizona has brought here also undreamed-of and far-reaching landscape possibilities. The monotonous desert levels, broken only by the saltbush and mesquite, are being increasingly planted with gardens and groves of date

palms—still in immature stage, but with occasional groups of the earlier plantings beginning to take on trunk heights of 20 to 30 feet and lifting their crowns above the level of deciduous gardens.

With an average height increment of more than a foot a year up to 40 or 50 years of age, a few years will see, all over the Coachella and Imperial Valleys in California and in the Salt River and Gila River Valleys of Arizona, groves and large plantations of stately date palms which will impart character and beauty to the entire landscape. Railroad companies which are prone to feature the scenic beauty of their territory may vie with one another in exploiting the date-growing mileage which the tourists may view from their trains. Instead of the remark of the disgusted southern tourist 15 years ago, as the train pulled westward from the Salton Sea, "Well, God 'Imighty sure did mighty little for this country," the fascinated traveler may exclaim that the beauties of the "Garden of Allah" and of the Nile Valley have been transferred to what was once the dreaded Salton Basin.

SUMMARY

Date culture in Egypt and the Sudan extends from north to south about a thousand miles, from the relatively cool and humid coastal region of Port Said and Alexandria to the extremely hot and dry region of the Third, Fourth, and Fifth Cataracts of the Nile. The extension of commercial date culture southward is checked by the beginning of tropical rains at Khartum. This wide climatic range gives rise to an equally wide variation in the date varieties and character of the product.

Economic as well as climatic conditions have led to the development of three well-defined regions of varietal date culture from what were haphazard seedling cultures of early periods, leaving two regions of great possibilities still in the domain of seedling culture.

The Nile Delta, excepting limited sections bordering the desert, is too cool and humid to mature dates with a sugar concentration sufficient for packing, but it produces vast quantities of dates eagerly consumed in the fresh (rutab) stage by the people of this densely populated region.

This demand has developed the Hayany variety, known for more than a century, into the most important commercial date of Egypt, but supplemented by the Amhat, and late in the season by Zagloul, Samany, and Bint Aischa.

Egypt has developed a small export trade in the Amri date, grown from an early time along the hotter border of the Delta next to the desert, and in recent years packed with considerable care for export to England and southern Europe.

The increased heat of the narrowing valley in Giza Province has made possible an important culture of the Saidy date from the Libian Oases, in Giza known as the "Sewi." This date, of high export quality, has been packed in the crudest manner and wholly consumed in Cairo and other cities of Lower Egypt. Varieties best meeting the home demand for both fresh and packed dates have thus developed in Lower Egypt, including Giza, and make it the first region of varietal culture.

The five Libian oases, watered from artesian wells, comprising the second varietal region, have from very early times made the exporting of dates to the Nile Valley their chief point of contact with the outside world. The Saidy date, now their main dependence, was listed by the explorer Cailliaud, visiting Siwa and Baharia in 1819, when its commercial prominence indicated a much earlier origin, with local history pointing to its introduction from the Said, or Upper Egypt, in the fifteenth century.

The third region of varietal culture is a broken stretch of very narrow Nile bottoms, beginning about Aswan and reaching to the border of the tropical rain belt below Khartum.

The region from Giza Province to Aswan, with the scarcely detached Fayum, has immense agricultural wealth, producing unfailing crops of sugar cane and grains, having about 4,000,000 taxed date palms, mostly of indifferent seedling quality, yet with a soil and climate capable of producing export dates equal to any in the world.

Out of a considerable list of Nile Valley date varieties only six have attained commercial importance. The Hayany, consumed in great quantities in the fresh rutab stage, heads the list in importance, supplemented by a growing production of the Amhat. A small export trade in the Amri variety is more than offset by importations from Tunis and Mesopotamia.

The Saidy of the Libian Oases, introduced as "Sewi" into Giza Province, a packing date of first quality and a long keeper, is packed in a crude manner and entirely consumed in densely populated Lower Egypt. The greatest possible expansion of Egyptian date culture lies in the planting of this variety in the middle Nile Valley, and the development of modern packing methods which will place it among the world's finest commercial dates.

The Barakawi of Sukkot and Dongola, known down the river as "Sukkoti," but more commonly as "Ibrimi," is perhaps the world's all-round best dry date. Until the world's white population learns to appreciate the merits of fine dry or bread dates, the markets for this excellent food product must be found, as now, among the native peoples of the interior.

The Bentamoda is a date of excellent dessert qualities, but for reasons not yet clear its culture has been largely confined to the gardens of the wealthy, and the fruit has found little place in commerce.

Some ideas new to American date culture have been outlined, perhaps the most important of these being the Egyptian commercial traffic in unopened male spathes, supplied to the garden owners for pollinating their palms.

Egypt, with more than 12,000,000 people and no deciduous forests, allows nothing to go to waste. Aside from the fruit, every part of the date palm has a value made possible by a surplus of low-priced labor. The strong, elastic midribs of the great date leaves are made into crates and containers of many sizes for many purposes, with patient skill by poorly paid hand labor. American date palms, like those in Egypt, must be pruned by removing 12 to 20 lower leaves each year. Shall these become a troublesome waste product, or can machinery replace hand labor and profitably convert these thousands of mid-

ribs into the many forms of useful crates and packages for which there is so great a demand?

Date varieties differ widely in their rate of height growth and the ultimate height they may reach. Opportunity was offered in Egypt to record the height and approximate rate of growth of more than 200 date palms of diverse ages and of four leading varieties. The curves of growth rate based on these measurements are the first of the kind ever offered for publication.

In Egyptian date culture the tree-climber's craft attains almost the dignity of a profession. With forests of palm trees 50 to 75 feet in height to be pruned, pollinated, and their fruit harvested, the growers simply could not do business without the tree climber. He trusts his life daily to his beautifully hand-woven climbing girdle and rope, made from the date-palm's own fiber. He is the aristocrat of the fellahs.

American date palms are passing the stepladder stage of height growth in rapidly increasing numbers. Shall it be "every man his own tree climber," or will a new profession arise to afford a safety valve for the athletic trend of the age?

A group or an avenue of lofty date palms has a beauty all its own and sounds the keynote for every landscape of which it is a part.

The crude mud-brick "esbet," or village, of the Nile is redeemed from utter ugliness and squalor by even a few feathery-topped palms seen against a glowing sky. The majestic sweep of a Cairo boulevard along the Nile bank owes its charm to the groups of bordering palms.

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